MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 40 | DECEMBER, 1933 | Number 4

PRINCIPAL ARTICLES IN THIS NUMBER

DEPARTMENTS

PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ROBERT B. LUCHARS, President EDGAR A. BECKER, Vice-pres. and Treasurer ERIK OBERG, Editor FRANKLIN D. JONES, Associate Editor
CHARLES O. HERB, FREEMAN C. DUSTON, Associate Editors

LONDON: 52-54 High Holborn PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.

Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

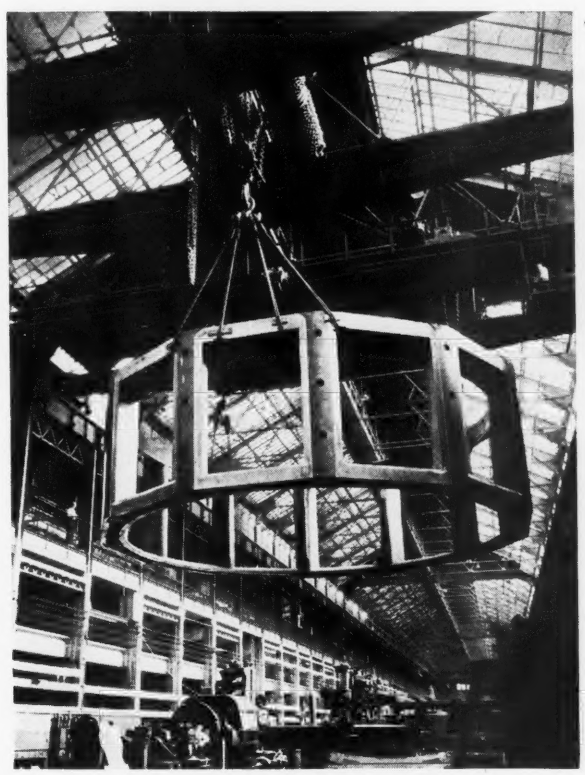
MACHINERY

Volume 40 NEW YORK, DECEMBER, 1933 Number 4

Machining the Gates for Boulder Dam

By D. B. CHARTERS, Manufacturing Engineer
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

The Boulder Dam is the Greatest Engineering Undertaking since the Building of the Panama Canal. Most Unique Methods Had to be Employed in the Machining of the Huge Gate Valves for Controlling the Water Flowing to the Power Plant that will Develop Nearly 2,000,000 Horsepower



MORE than 2300 tons of steel and other metals are required in the building of the largest valves ever constructed. These valves are for the Boulder Dam, the greatest engineering undertaking since the building of the Panama Canal. To ship these valves from East Pittsburgh, where they are manufactured, to the Boulder Dam will require about ninety railroad cars. A total of eight gates will control the flow of water to a power plant which will ultimately develop 1,835,000 horsepower.

Each gate assembly consists of a throat liner, a cylindrical valve, a nose liner, valve guides, and minor fittings. With the exception of the cast-steel throat liner and the small deflection plates, each gate is fabricated entirely by arc welding from huge steel plates. Eighty welders have been trained for this job. More than one mile of welding was used in the fabrication of each gate.

Not only is the Boulder Dam the greatest engineering undertaking at the present time, but the dam will be the highest and largest ever constructed, forming the largest artificial lake in the world. The eight circular gate valves that control the water flow into the penstocks leading from the lake formed by the dam are placed, two each, in four concrete towers rising from the bottom of the lake and extending well above the surface of the water. These towers are approximately 340 feet high, and the gates are placed one in the bottom of the tower and another up about 150 feet, while at the top is a cir-

cular building containing the machinery for actuating the valves. The inside of the tower has a clear diameter of 30 feet, while the outside diameter at the base is about 95 feet.

The gates themselves are 32 feet in diameter by 10 feet high over all, the lower gates weighing 256,000 pounds each, and the upper gates 169,000 pounds. The nose liner, which forms the water openings and into which the gate slides, has an inside diameter of 32 feet and a height of 11 feet 6 inches. The lower nose liner weighs 227,000 pounds, and the upper 188,000 pounds. A good idea of their shape and size can be obtained from the heading illustration, which shows the liner, partially machined, suspended from two cranes.

One of the major parts of the gate is the throat liner, Fig. 1. The gate is movable, while the nose and throat liners are bolted together and built into the concrete tower. The assembled gate unit is shown in Fig. 3.

In the construction of the eight gates the following material was used:

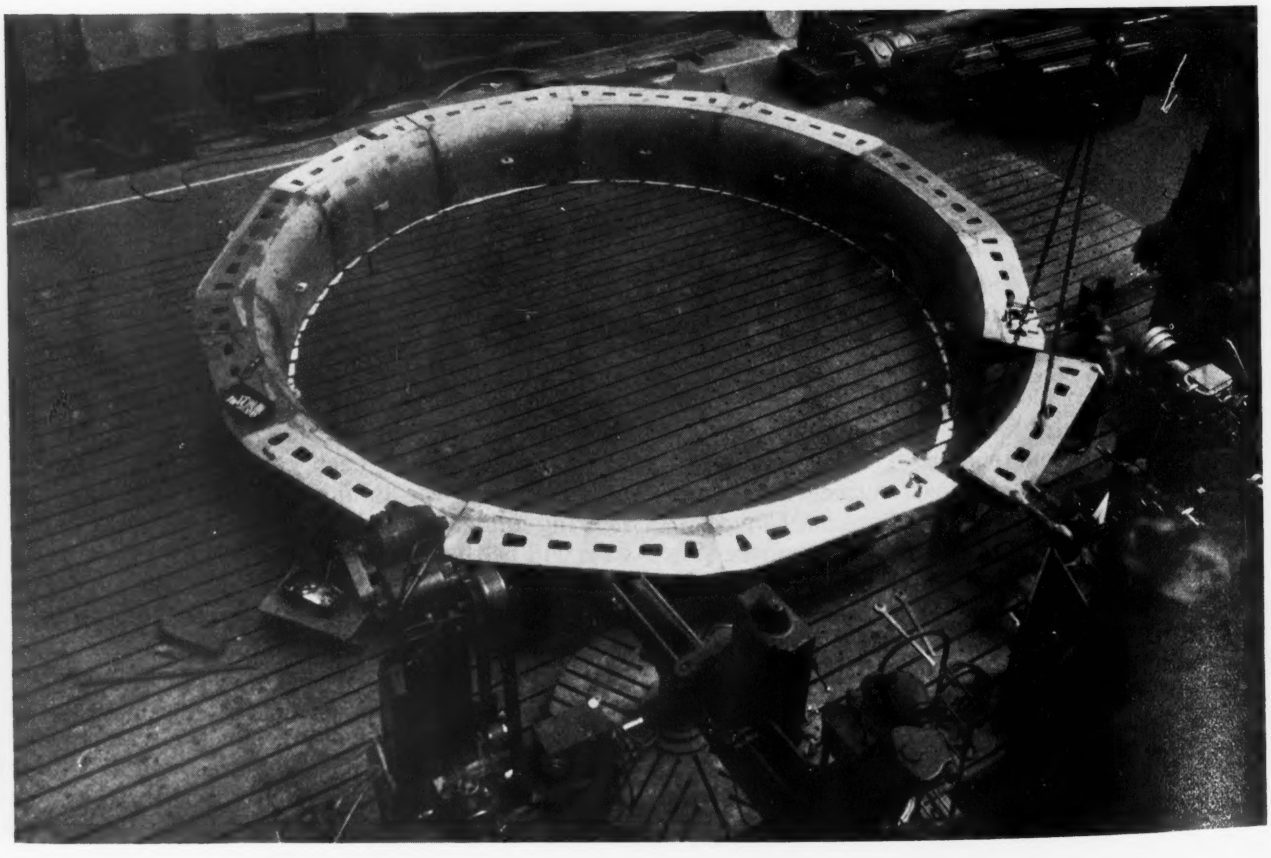
	Pounds
Copper bearing steel plate	3,440,000
Ferrous castings	850,000
Bronze strips and castings	87,500
Monel metal seats	111,240
Monel metal screws and bolts	15,000
Stainless-steel bolts	34,000
Steel bolts, studs and nuts	30,000
Structural shapes	14,500
Welding rod	20,000
Total	4,602,240

Because of the large size and weight of most of the parts for the gates, together with the high degree of accuracy required, a number of rather unusual problems were presented to the machining departments of the Westinghouse Electric & Mfg. Co., where these gates were fabricated. It is the purpose of this article to show how these problems were solved.

The Throat Liner and How it Was Machined

The throat liner consists of twelve castings (steel for the lower and semi-steel for the upper gates), machined at the partings and bolted together to form a circle having an inside diameter of 30 feet. (See Fig. 1.) The first operation was for the purpose of removing as much stock as possible from the flange before turning and facing, and at the same time providing a suitable base from which to set up for the very particular job of machining the partings and drilling for the bolt holes. Fig. 4 shows

Fig. 1. One of the Enormous Throat Liners Forming a Part of Each of the Eight Circular Gate Valves that Control the Water Flow from the Lake Formed by the Boulder Dam



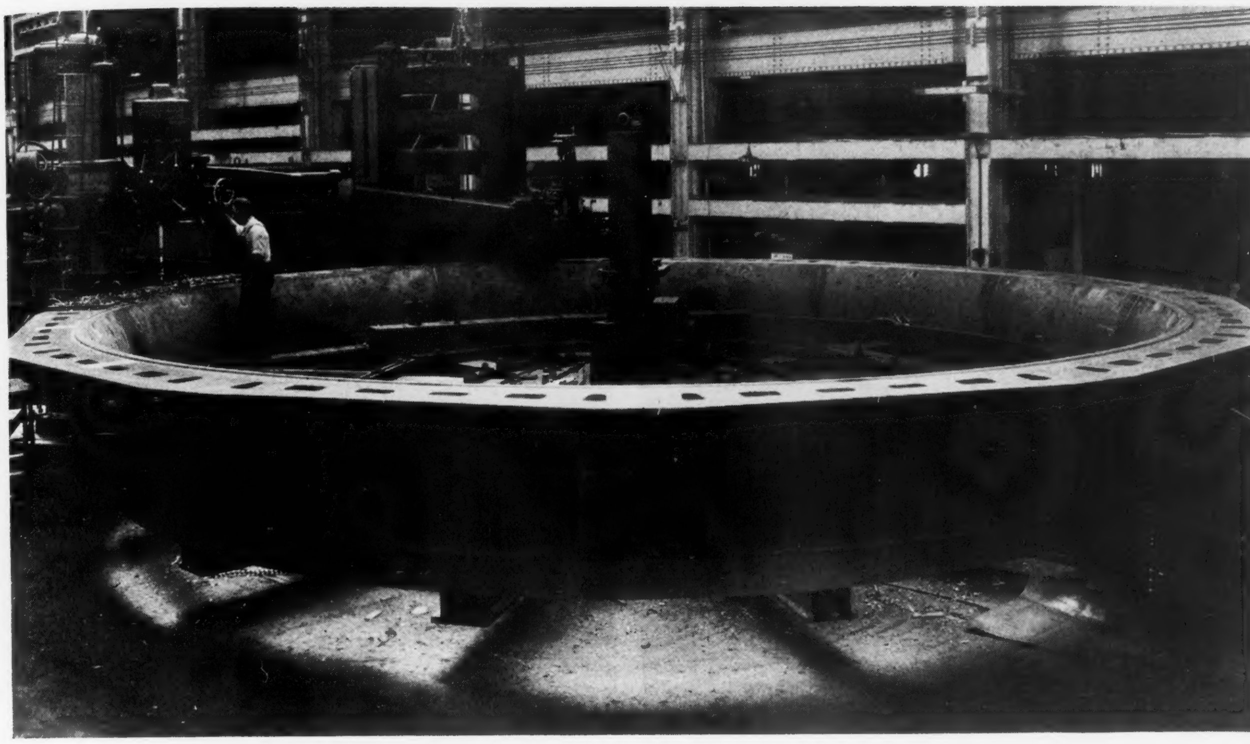


Fig. 2. Twenty-eight-foot Boring-mill Table, an Open-side Planer, and a Radial Drilling Machine Arranged for Turning and Drilling the Throat Liner and its Monel Metal Seat

two segments on a ten-foot planer ready for this operation. A second planing operation served to straighten up the bottom of the skirt and machine the support lug on the inner diameter which was used for mounting the throat liner on the boring mill.

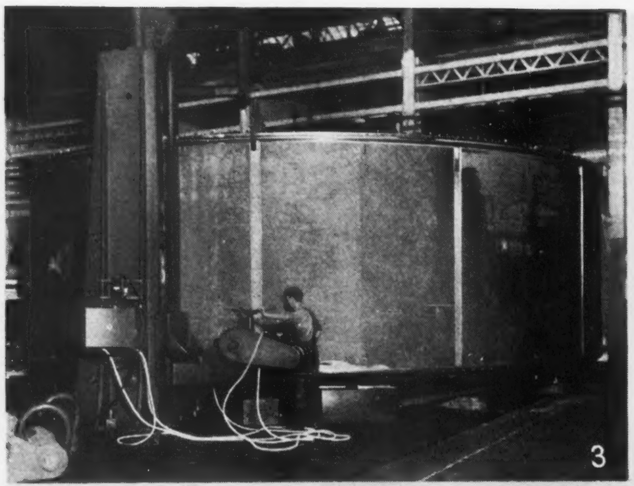
The segments were then mounted on a large indexing table on a horizontal boring machine, Fig. 5, where both ends could be milled and drilled without changing the setting. By the use of indexing marks on the rotating table, all angles and chords were made equal, and by setting the drill jig to conform to the inner diameter, a practically perfect circle was obtained. When the ends of the first complete ring were bolted together, the inner diameter was within 1/4 inch of being a perfect circle, and the maximum error in perfect fits at the partings was 0.002 inch.

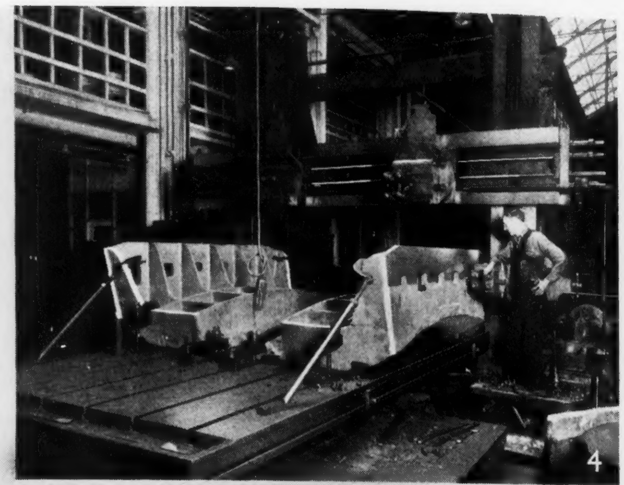
Fig. 2 shows the boring mill provided for turning the throat liner and the Monel metal seat which was attached before removing the throat liner from the mill. This mill was improvised by removing the rail and housings of a regular 28-foot boring mill and setting up the housing of an open-side planer to support the cutting tools. Another toolpost was provided for turning the outside diameter of the skirt. The radial drill shown was used for drilling the bolt holes in the horizontal flange while the liner was mounted on the mill, thus saving much handling as well as twelve individual set-ups.

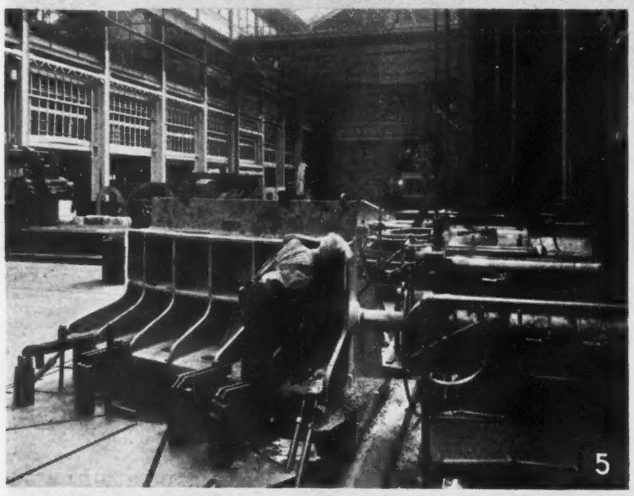
Since the Monel metal seat which is attached to the throat liner had to be turned in position, a special drilling and tapping set-up was made, as shown in Fig. 6. Here the drill was mounted upon a swinging arm pivoted in the center of the boring mill table and supported by two wheels running on the track that may be seen in the lower right-hand corner. The drill jig was provided with clamping devices for pulling the seat into place, since no opening as great as 0.002 inch was permitted between the seat and the throat liner in any place. After the Monel metal seat was secured in position, it was turned to form with the radius turning device shown in Fig. 7. Following the turning operation, a motor-driven buffing wheel was used for polishing the seat.

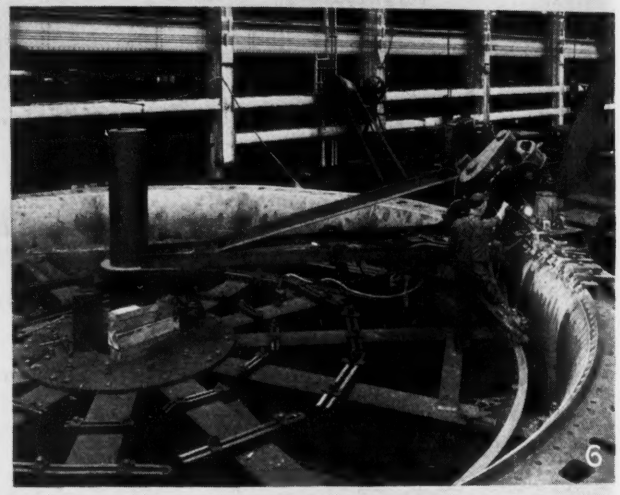
Construction and Fabrication of the Gates

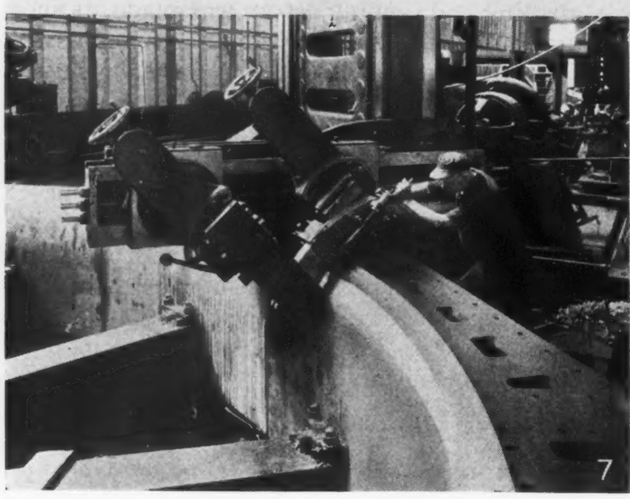
The gates proper were made in six segments, bolted together with a 20-gage copper gasket at the partings. The gate segments were made of rolled and formed sections heavily welded together, the principal member being the outer cover plate, 2 inches thick by 120 inches wide and 192 inches long. Some explanation of the forming of the more important members might be of interest, even though they are not strictly machining problems. Fig. 8 shows the plate member of a gate segment being formed. The follow-up rolls on each side were necessary because the weight and length of the plate were sufficient, in the extreme position, to almost











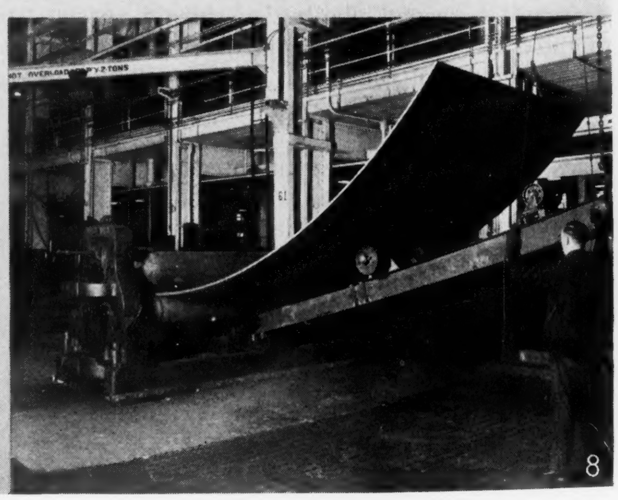
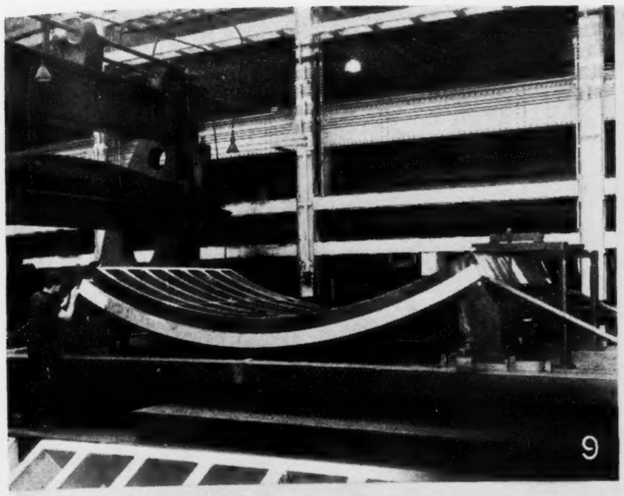
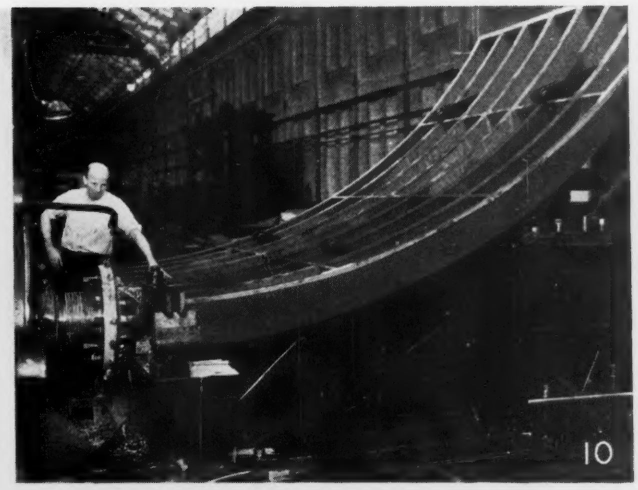
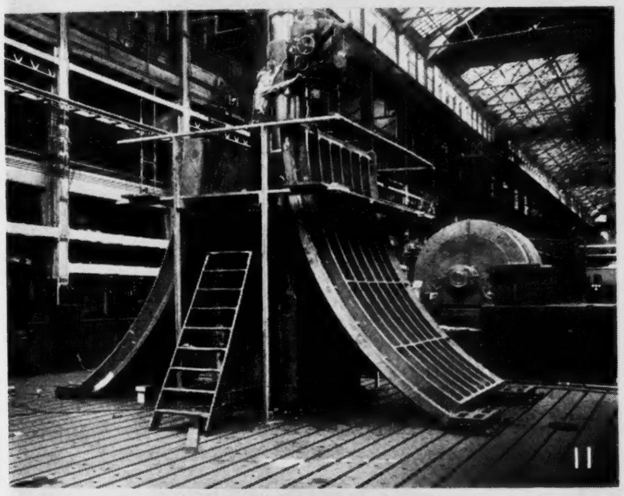
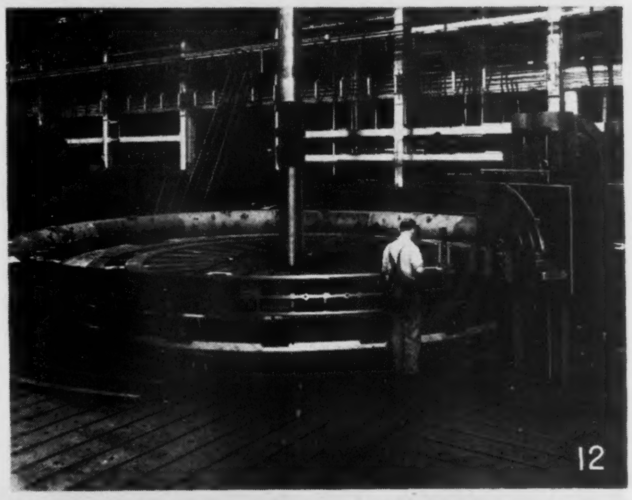


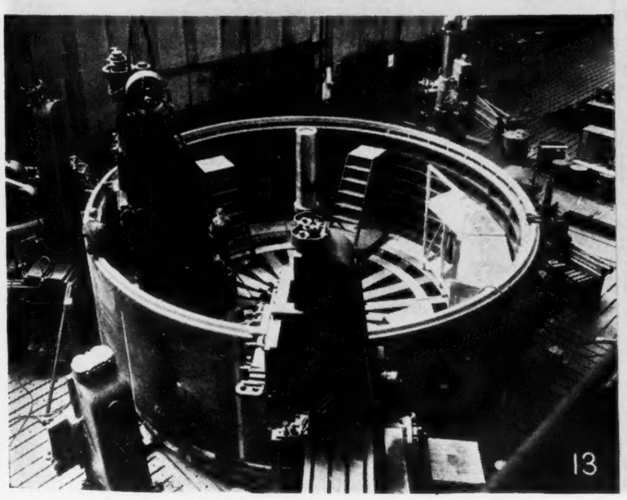
Fig. 3. One of the Assembled Gate Units, Each Weighing over 120 Tons. Fig. 4. Two Segments of the Throat Liner Mounted on a 10-foot Planer. Fig. 5. Segment of the Throat Liner Mounted on the Large Indexing Table of a Horizontal Boring, Milling, and Drilling Machine. Fig. 6. The Drilling and Tapping Set-up for the Bolt Holes in the Monel Metal Seat and the Throat Liner. Fig. 7. Turning the Monel Metal Seat by Means of a Radius Turning Device. Fig. 8. Forming the 2-inch-thick by 10-foot-wide Plate Member of a Gate Segment, Using a Jib Crane as Auxiliary Support











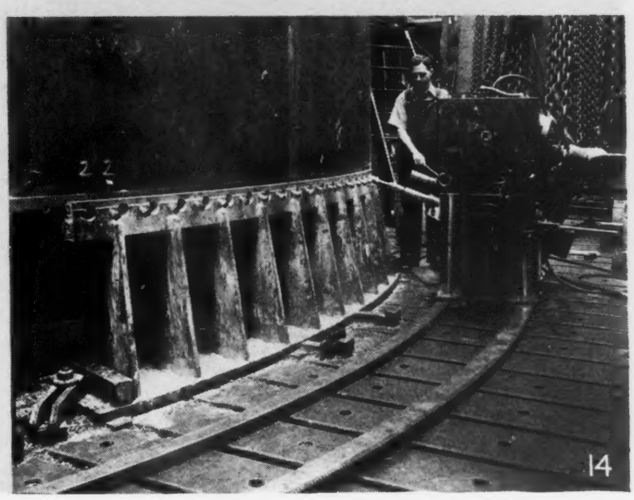


Fig. 9. Marking the Finish Lines for the Partings on the Gate Segments after They are Planed. Fig. 10. Machining the Gate Segments on the Parting Surfaces. Fig. 11. Drilling and Spot-facing the Bolt Holes in the Partings of the Segments. Fig. 12. Boring Mill Used for Machining the Gate after the Segments are Assembled into a Complete Circle. Fig. 13. The Gate Mounted on the Boring Mill Shown in Fig. 12, Ready for Machining. Fig. 14. Combination Drill Jig and Clamp Made for Holding the Lower Gate Seat in Place while Drilling and Tapping for the Monel Metal Screws

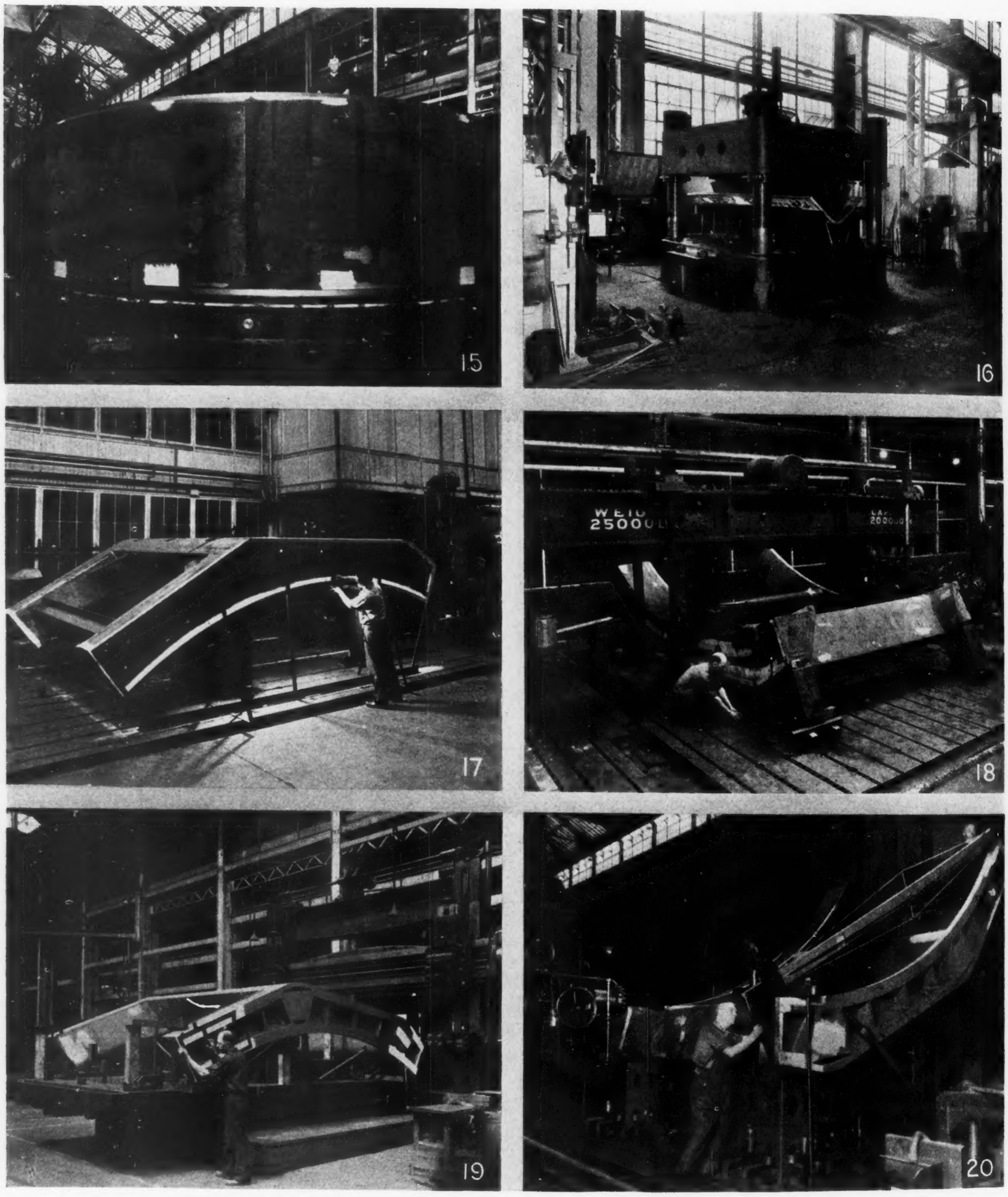


Fig. 15. A "Merry-go-round" on which the Gate is Mounted for Operations Other than Boring and Turning, which Enables it to be Moved around with Comparative Ease. Fig. 16. The Forming of the Nose-piece for the Upper Throat Liner from a Plate 1 3/4 Inches Thick, 58 Inches Wide, and 12 Feet Long. Fig. 17. Checking the Shape of the Nose-liner Segments. Fig. 18. Correcting Errors in Liner Segments Due to Distortion in Welding, in an Improvised Press. Fig. 19. Planing Top and Bottom of Liner Segments on a 14-foot Planer. Fig. 20. Milling and Drilling Operations on the Nose-liner Segment

upset the rolls, and at the same time deform the plate from the radius intended. The pull on the jib cranes was regulated by calibrated industrial locomotive springs; by observing the amount of deflection, the operator could prevent overloading of the cranes. The plates were trimmed and beveled for welding on a 14-foot planer previous to rolling. The stiffening ribs were rolled in half circles of the proper diameter and subsequently cut into thirds. After the gate segments had been fabricated, annealed, and straightened, they were machined.

Machining Operations on the Gate Segments

The first operation was to check for all machining allowances and lay out for set-up on the planer, where the top and bottom of the segments were planed to size. This operation was the starting point for all subsequent machining operations, and obviated a facing operation on the bottom of the gate or the necessity of turning the gate over on the boring machine. After the top and bottom of the segment were finished and before it was moved from the planing fixture, the finish lines for the partings were marked by means of a straightedge doweled to the fixture. Fig. 9 shows this set-up for planing and the marking device in use. The gate segment was then mounted on the horizontal boring machine for finishing the partings, the segment being squared up to the lines scribed while mounted on the planer, and machined as shown in Fig. 10. The surface to be machined was 13 1/4 inches wide by 120 inches long, with from 3/8 to 5/8 inch of metal to be removed. The roughing cut, which averaged 1/2 inch deep, was made with a feed of 3 inches per minute, the cutter speed being 8 revolutions per minute. The cutter was made up of sixteen regular 1 1/4-inch square boring mill tools, mounted in a suitable body, with an approximate cutting diameter of 19 inches. For finishing, one special broad-nosed lipped tool was inserted and set about 0.010 inch above the other tools.

The next operation was the drilling and spot-facing of the bolt holes in the partings, as shown in Fig. 11. At the top of the parallels carrying the drilling machine were jack-screws on each side, bearing against the gate, so that leveling for drilling was quickly accomplished. These are not discernible in the illustration, but as time-savers are worth mentioning.

Improvised Boring Mill for Huge Work

After the segments were assembled into a circle, the gate was placed on a boring mill which had been rigged up for this particular job. An idea of the construction of this machine can be obtained from Fig. 12. Mounted on the machine in Fig. 12 are the deflector segments which are used on the four lower gates only.

The boring mill is arranged with H-beam outriggers attached to the original table. At the outer end of each beam is a heavy cast-iron shoe sliding on a cast-iron track bolted to the floor plate, the sides of the track being higher than the sliding surface, so that there is always a pool of oil over the wearing surface. This arrangement provided a machine that was remarkably smooth in action, both empty and loaded. The outriggers were made in four sections, so that the machine could be returned to its original condition quickly.

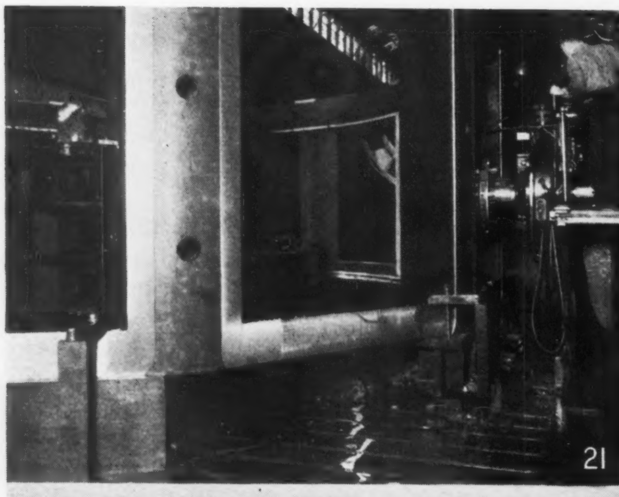
Fig. 13 shows the gate mounted on the boring mill shown in Fig. 12. Besides the boring and turning, which could only be done on the boring mill, a number of other operations were performed before removing the gate, because of the convenience of being able to rotate the gate relative to machine tools mounted about the circumference. While mounted on the boring mill the following operations were performed: (1) Bore and face for deflector segment at top of gate. (2) Drill for deflector segment. (3) Mill and slot for stainless-steel guide shoes. (4) Turn face and drill for upper adjustable gate seat and clamping ring. (5) Mount upper gate seat and turn. (6) Turn and face for lower gate seat. (7) Drill and tap for lower gate seat, bolt gate seat into position, turn and polish. (8) Finish pads for lifting bolts.

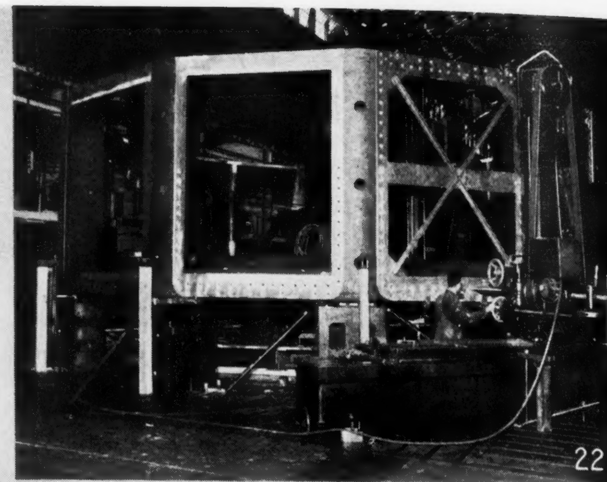
Machining Guide Shoes and Gate Seats

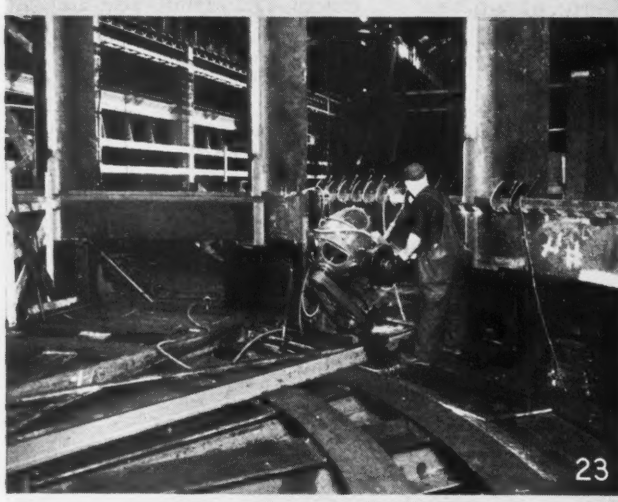
The guide shoes were of stainless steel, 5/8 inch thick by 4 inches wide and 9 feet long, twelve in number. These strips were bolted into slots 1/4 inch deep, and since the slot lengths were beyond the capacity of any one machine, it was necessary to mill a portion of the slot at one station and finish up at another station with a machine set lower. The radial drill shown in Fig. 13 was used for drilling the holes for the deflector segment and upper seat, while the slotter machined the pads to which are attached the bolts for raising and lowering the gates.

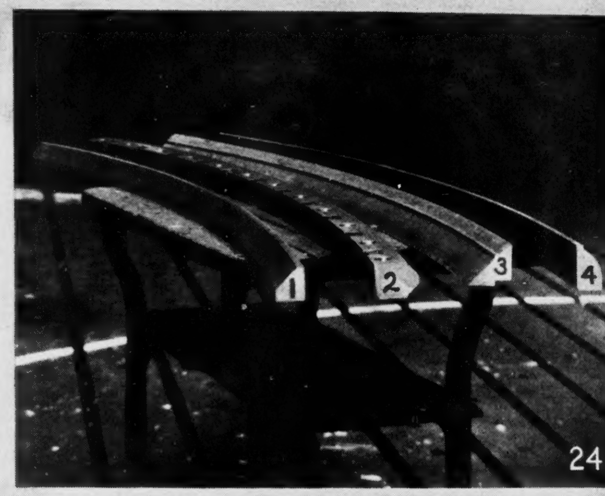
Fig. 14 shows the combination drill jig and clamp made for holding the lower gate seat in place while drilling and tapping. This Monel metal seat was made in twelve segments, with tight butt joints, each segment held in place by seventeen screws. The drilling machine was mounted on trunnions for angular adjustment, and was moved along the circular track by means of a rack and pinion. The tap-size hole was drilled through the seat and into the gate, after which the hole was opened up with a combination drill and counterbore for the fillister-head screws. The hole was then tapped and the screw inserted and pulled tight. After the twelve segments were mounted, the straight and conical portions of the seat were turned, and the curved surface finished with an attachment similar in design to that shown in Fig. 7. Owing to the length of time required for these operations on the large boring mill, it was found necessary to provide means of handling the gate for operations other than boring and turning, so a "merry-go-round" was constructed, as shown in Fig. 15.

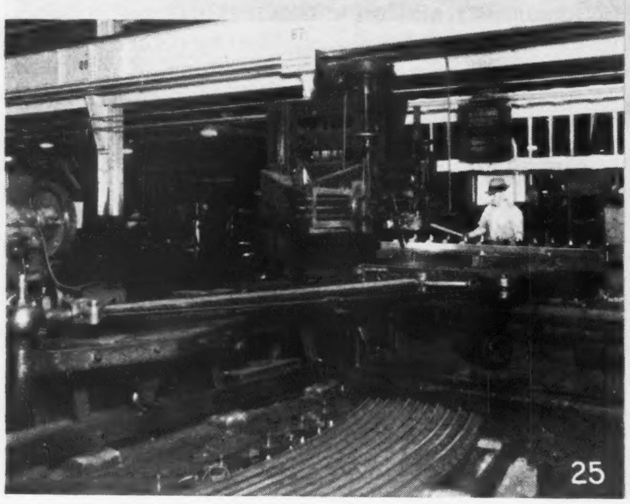
Another major part of the gate assembly is the nose liner—the stationary part in which the gate proper slides. Its construction is shown in the head-











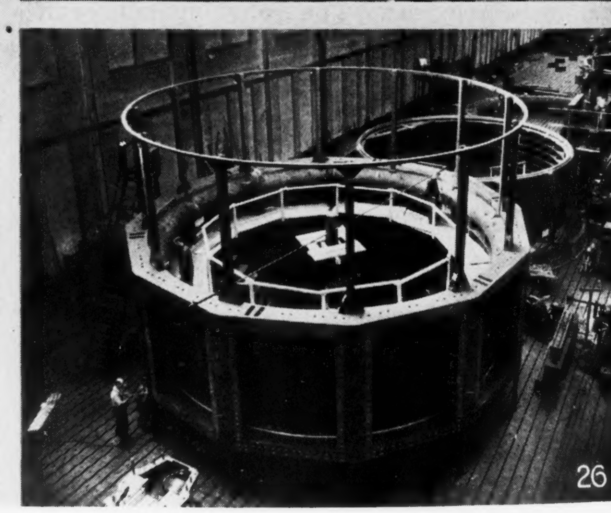


Fig. 21. Machining the Faces of the Nose Liner Segments on a Large Size Horizontal Boring Machine. Fig. 22. Many Types of Machine Tools were Mounted Temporarily in Position for Finishing Operations on the Nose Liner. Fig. 23. Drilling and Tapping for the Monel Metal Seat on the Nose Liner. Note Arm Pivoted at Center of Table. Fig. 24. Cross-sections of the Four Different Monel Metal Seats. Fig. 25. Taking a Finishing Cut on Seat Sections on a Radius Planer. Fig. 26. The Complete Gate Assembly with the Exception of the Inner Cover Plates of the Gate Segments

ing illustration, page 193. This member is also made in six segments, the partings coming in alternate water openings. Some of the operations previous to the actual machining will be touched upon.

Fig. 16 shows the forming of the nose-piece for the upper throat liner, this plate being 1 3/4 inches thick, 58 inches wide and 144 inches long, and is formed hot in one operation. The part is shown partially formed, and the construction of the fabricated forming die is plainly shown. There were also two other shapes formed in this press—the warped plates for the top and bottom of the water passage. Cast-iron forming dies were used, each die weighing about 11,000 pounds.

After being fabricated and annealed, the nose liner segments were checked for shape, as shown in Fig. 17. Any errors due to distortion in welding were removed by means of the improvised press shown in Fig. 18. The principal force was applied by a hydraulic cylinder of 800 tons capacity, piped up to a pumping unit. The hydraulic jack shown at the right-hand side was used only to hold the segment in place when pressure was applied on the opposite end. The full pressure of 1,600,000 pounds was required to give a permanent set of 1/8 inch.

Machining Operations on the Nose Liner

After the straightening, the first machining operation was the planing of the top and bottom of the segment on a 14-foot planer, as shown in Fig. 19, which also shows how the lines for the set-up on the following operation were placed on the segment after planing, the slabs on which the part rests having been planed and clamped so that an offset on the gage brought the parting lines to the same position each time.

The nose liner segment was then mounted in front of a horizontal boring machine as shown in Fig. 20. The ends were milled, drilled, and a keyway cut, the final operation on this set-up being to check the partings for the proper angle and chord with the gage shown in use. The segments were then assembled into a circle on a floor plate, where all dimensions were again checked and the various finishes indicated and marked. The assembled circle was next moved to a large horizontal boring machine, Fig. 21, where the faces for the nose liner segments were finished. This operation completed, the nose liner circle was disassembled and turned over, reassembled, and placed on the floor plate around the large boring machine previously mentioned. The part was turned over so that it would be possible to drill and tap the holes in the bottom while it was in position on the boring machine. For attachment to the throat liner there are three hundred and twelve 1 1/2-inch tapped holes and twenty-four 1 1/2-inch dowel-pin holes. The tools were mounted on the boring machine table, so that after the boring and facing operations, the machine could be used for positioning the tools for drilling and milling.

The lower portion of the nose liner has a bore surface 32 feet in diameter and 3 1/2 inches wide, and with the part upside down on the floor plate, this surface was 15 feet up from the floor plate or 13 feet above the boring mill table. To reach this with a boring tool it was necessary to use a tool attached to the ram of a slotter, and because of the difficulty of taking a steady cut at this distance from the tool base, a grinder was attached to the toolpost for the finishing operation. This slotter, with the grinder mounted in place, can be seen faintly through one of the water openings in Fig. 22. It will be noted that in one setting the horizontal drilling machine can drill but half of the holes necessary in the water entrance face, so two drill jigs were provided in order that two openings could be worked upon at once. In these faces there are 1104 tapped holes 1 1/2 inches in diameter and twenty-four taper-pin dowel-holes of the same size.

Milling and Drilling the Bronze Shoes

Extending vertically along the inner edge of the twelve columns is a bronze shoe, against which the stainless steel shoe in the gate proper has its bearing. The purpose of this arrangement is to hold the gate central as it is raised or lowered. The same procedure was used in milling these as for the corresponding slots on the circumference of the gate itself; that is, at one station half the length is milled and at the next station another machine finishes the slot. The drilling for the holding screws for the bronze shoes was done in the same way.

In this part (the nose liner) there is but one Monel metal seat, a triangular section fastened in an offset about 22 inches below the top of the member. Because of the fact that the liner is inverted for machining purposes, it was necessary to drill and tap upward at an angle of 45 degrees with the axis of the nose liner. The drilling set-up is shown in Fig. 23. It will be noted that in this case the seats were drilled and counterbored before mounting, because of the difficulty of designing a drill jig that could be conveniently worked in this position and because of the awkward clamping facilities available. This drilling arm was pivoted in the center of the table and was provided with two wheels on eccentric shafts which served to raise the arm clear of the table for moving from hole to hole. After reaching the next hole, the arm was dropped back on the table for the drilling operation.

A record of the amount of drilling and tapping in one of the nose liners may be of interest: 1458, 1 1/2-inch tapped holes; 204, 2-inch pipe tap holes; 48, 1 1/2-inch taper-pin dowel-holes; and 60, 2 1/8-inch clearance bolt holes. This occurs eight times on the job, counting the nose liners only.

The Monel Metal Seats and How They are Made

Fig. 24 shows the four different Monel metal seats ready for mounting on the job. No. 3 is the throat liner seat, or the lower stationary seat. No. 1 is the upper seat on the nose liner, also stationary. No. 4 is the bottom gate seat (shown inverted) which, in use, bears against No. 3; and

Fig. 27. Drilling One of the Monel Metal Nose-liner Seats Ready for Mounting on the Liner. This is the Upper Seat on the Nose Liner (Number 1 in Fig. 24)

Fig. 28. Suspended from the Crane is One of the Twelve Bronze Clamping Segments, while Beneath are Shown the Fixed Liner Seat and the Adjustable Gate Seat

No. 2 is the upper gate seat, which is adjustable for diameter and, in use, contacts with seat No. 1. Seats Nos. 3 and 4 were drilled in place, while seats Nos. 1 and 2 were drilled previous to assembly.

The first step in the machining of these seats was to plane them while straight, approximately to size, allowing most of the finish on the surface which was to be finished after they were mounted on the job. The next operation was crimping and rolling to the proper radius. Those seats having flat parallel surfaces were then finished to size as regards thickness, leaving two surfaces untouched. Seat No. 2 was drilled and slotted for the adjusting wedges and the ends milled to the proper chord and angle; it was then ready to mount on the upper part of the gate and finish-turned in position. The other three sections were next placed on a radius planer (Fig. 25) and a light cut taken on the surfaces which were to be in permanent contact with the gate parts. This served to bring them square and flat within 0.001 inch. They were then trimmed to length and seat No. 1 was drilled (Fig. 27).

The drilling for all the seats except the upper movable seat (No. 2) has been described. For this, an ordinary plate jig and radial drill were used.

The steel sector on which seat segment No. 1 was mounted was moved by a chain and sprocket and indexed by means of a pin inserted in the steel sector; this construction was comparatively inexpensive and proved very satisfactory.

The gates were so designed that three fixed seats were used, all variations being taken up and a water-tight joint insured by the adjustment of the upper seat upon the gate against the upper fixed seat in the nose liner. Fig. 28 shows the construction of this portion of the gate. Suspended from the crane is one of the twelve bronze clamping segments, while immediately beneath can be seen the fixed seat of the nose liner and the adjustable seat of the gate through which the studs are protruding. The studs extending through the round holes in the seat are the clamping studs, while between them are collared studs which serve to move the seat outward by means of tapered wedge-nuts which engage a tapered slot in the seat.

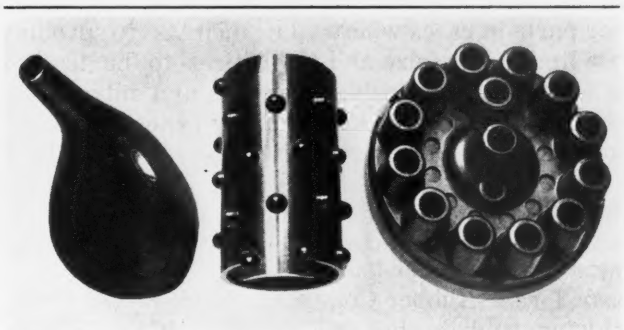
Fig. 26 shows the complete gate assembly, with the exception of the inner cover plates of the gate segments, which were removed so that the gate could be lifted. The gate is in the shut position. The standards and structural steel ring at the extreme top are the gate guides, which are embedded in the concrete of the tower and serve to keep the gate central and prevent it from turning while in the open position. If the reader can visualize twelve large cast entrance liners extending radially from the water openings for an additional distance of about 8 feet on each side, an idea of the immense size of these water control gates will be obtained. The weight of the complete unit, as shown in Fig. 26, is over 260 tons.

Synthetic Plastic Materials

Their Characteristics and Applications

By HERBERT CHASE
Consulting Engineer, New York

A Review of the Different Types of Plastic Materials Available, and an Outline of the Methods Used in Their Production—Second Article



Golf Club Head Having High Impact Strength; Wear-resisting Breaker Roll Used in Silk Manufacture; and Distributor Head of High Dielectric Strength—Made from Bakelite by the Boonton Molding Co.

IN the first of these articles dealing with plastic materials, published in November MACHINERY, page 137, a review of the classification of plastic materials was given, and the general characteristics of phenolic and cold-molded plastics were dealt with. The present article will deal with rubber-base and urea plastics and will discuss briefly a number of other plastics, such as shellac, casein, nitro-cellulose, styrol, vinyl, and glyptal, that are of industrial importance.

Rubber-Base Plastics

Rubber, in its various forms, is perhaps the most widely used of all plastics, although in its hard-molded forms it has been largely replaced by the molded forms of phenolics, partly because the latter are more rapidly molded and partly because they have certain advantages in respect to finish and are superior in some physical qualities. When a soft or relatively yielding material is required, however, rubber has no close competitor.

There is also a new thermo-plastic material made from a rubber base which molds into relatively hard forms very rapidly and without any vulcanizing. It softens when heat is applied above a certain temperature and can be remolded, as it does not undergo chemical change in the molding process, like vulcanized rubber and the thermo-setting plastics, such as the phenol and urea types.

Hard rubber, or vulcanite, as it is often termed, is not a fixed product, but varies in composition. Although the base is rubber, the fillers used vary widely, both in nature and proportions. They include hard rubber dust, whiting, clay, talc, asbestos, mica, zinc oxide, and other materials, used in proportions up to 50 per cent of the compound. Naturally, the physical qualities vary, but the dielectric qualities are excellent when the molding is new, although the surface resistance is rapidly destroyed by exposure to sunlight or ultra-violet light.

The molding time varies for different kinds of rubber, but can be reduced to twenty minutes or less. The heat resistance is low, as the material softens at temperatures of 130 to 160 degrees F., but the resistance to water and to many chemicals, including most acids and alkalies, is high. The machining qualities are excellent. The disadvantages include the long curing time, softening under heat, inflammability, and the tendency to soften and swell in mineral and some other oils.

The characteristics of soft rubber in its molded form are too well known to require much amplification. The tensile strength is 525 to 600 pounds per square inch; the water absorption is low; the specific gravity 0.97 to 1.25; and the heat resistance, without softening or charring, 150 to 200 degrees F. Its ability to withstand and absorb shock and to resist abrasion is highly important. It even makes an excellent bearing material when used under water or when thoroughly water-lubricated. Its resilience makes it an excellent cushion against the transmission of vibration, and it is coming to have wider use in machine and similar parts on this account.

It is readily vulcanized to some metals and adheres to the metal with great tenacity under stress.

Heat causes soft rubber to soften further and lose its strength, and exposure to sunlight, if prolonged, causes it to crack and deteriorate. It is not easy to machine, but can be cut with proper tools and can be ground. It has good resistance to water and to many chemicals, but, in general, is softened and swells when in contact with mineral oil and some other oils, although some special forms of rubber are not so affected.

Both hard and soft rubber are formed to shape in molds, which are usually made of soft metals that are not attacked by the sulphur used in vulcanizing. Hard polished steel molds are sometimes used, however, for hard rubber parts in cases where the parts must be held to close limits as to size and where a somewhat lustrous surface is desirable. Otherwise, the surface of hard rubber is dull, but it can be buffed to a high polish.

Plioform, a New Rubber-Base Plastic Material

Plioform, the new thermo-plastic rubber-base material made by the Goodyear Tire & Rubber Co., is molded, not like the vulcanizing rubbers, but in the same way as other thermo-plastic materials, such as cellulose acetate and cellulose nitrate. The process, in fact, is similar to that used for the phenolic resins, but the molding temperature recommended is a little lower—270 degrees F. No time is required for curing, as no chemical change takes place. The molded part must be cooled prior to removal from the mold, however; hence the mold is usually channeled for the alternate admission of steam and water.

This plastic is made in hard, medium, and soft grades, the hardest being capable of immersion in boiling water without softening. It is similar to other rubber-base materials in its resistance to moisture and to chemicals, in having excellent dielectric qualities, in being softened by oils (although a simple treatment makes it oil resistant), and in being combustible. This material is said to be little affected by sunlight or ultra-violet light. It is easily machined and is usually mixed with the same type of fillers as are used with phenolic plastics. However, it can be molded without a filler, in which case it is transparent and a light amber color. It can be dyed to almost any color that is not lighter in hue than the natural color, and can be used with a paper filler to make translucent materials, if desired, or with pigment of almost any color when the usual fillers are employed.

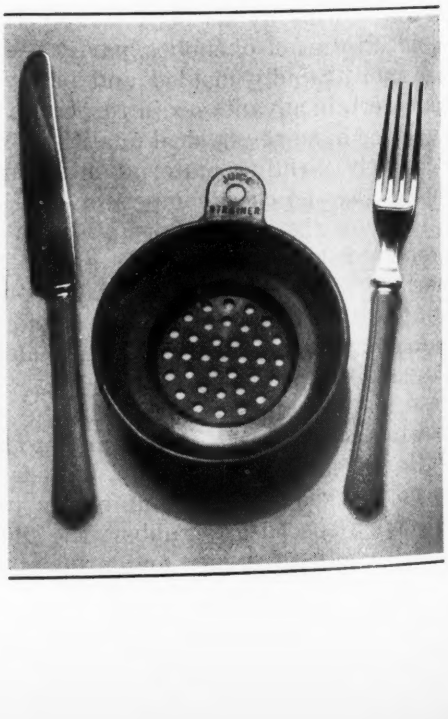
This material lends itself, therefore, to the production of many decorative effects, which may be plain, variegated, or mottled as desired, and may be such as to produce iridescent effects. As it promises to be less expensive than the cellulose acetate and nitrate materials, and can be had in equally beautiful colors, it seems likely to find wide use in applications in which decorative appearance is desired. Molding pressures of 1500 pounds per square inch are recommended, and the same molds that are used for phenolic molding can be employed.

Characteristics of Urea Plastics

Another type of plastic material that has gained extensive use, especially when bright translucent colors are desired, is the urea type, marketed under the trade names of Beetle, Plaskon, Unyte, Aldur, and Luxite. The earlier form of Beetle was a thiourea product which, being somewhat corrosive as a molding compound, required the use of chromium-plated or other corrosive-resistant molds, but the later forms of this make are a "straight" and non-corrosive urea resin, moldable in ordinary steel molds; the same is true of the other urea products referred to.

All resins of this type undergo an irreversible chemical reaction during the curing process that renders them insoluble in water, if the cure is complete; hence, they are classed as thermo-setting or reactive resins. As the urea resins are usually more

(Left) First Complete Radio Receiver Designed to Slip into an Overcoat Pocket. It is Housed in a Bakelite Case. (Right) Cutlery Handles and Fruit Juice Strainer Made in Pastel Colors from Unyte by the Boonton Molding Co.



expensive than the phenolic type and sometimes require closer control of the molding process, they are employed chiefly where their attractive translucent colors are an asset. Many of the physical properties are similar, and the general molding procedure is also similar to that used for phenolics, although the temperatures used are sometimes a little lower and the pressures recommended are rather higher.

Filler Used in Urea Plastics

Paper is the filler most commonly employed, because it helps to secure the translucent effect and brilliant colors desired and avoids the mottled effects that wood flour and some other fillers give. Best results are usually secured with thin sections, presumably because a complete cure is more certainly effected. Thick sections sometimes lead to subsequent cracking, especially around the inserts. Such effects are usually attributed to water absorption and appear to be much less likely to occur when thorough curing is effected. Increased curing time is usually recommended for articles intended for use in contact with water, but overcuring, especially if the temperature of the mold is a little too high, may produce a casehardening effect and possible discoloration.

Tests made by the Underwriters' Laboratories on one prominent make of urea plastic indicate that exposure to a temperature of 300 degrees F. or above tends to cause loss of luster, and as the temperature is increased, blistering and discoloration occur. In the case of Beetle, short exposures to temperatures of 245 degrees F. are permissible, and prolonged exposure to temperatures of 150 degrees F. are said not to be detrimental. Immersion of well cured moldings in boiling water for thirty minutes results in the absorption of 2 to 3 per cent of water, but is said not to damage the finish or impair the strength of the piece.

Urea plastics can be burned, but do not readily support combustion. They are odorless and tasteless at ordinary temperatures if properly cured. Although sometimes termed "unbreakable" in the sense that, in the form of dishes, for example, they are not easily shattered when dropped on the floor, the average molding is somewhat brittle. Its impact strength is in about the same range as that of the phenolic plastics. The scleroscope hardness of one make is given as 80 to 95. The dielectric properties are fairly good, but are affected, of course, by water absorption. Dimensional changes approximating 0.5 per cent sometimes occur in natural ageing within two months. Shrinkage in cooling after ejection from a mold is given in one case as 0.006 inch per inch. Outdoor exposure causes some of the colors to fade and may produce cracks.

Other Plastics of Industrial Importance

There is a long list of other plastics, some natural, but mostly synthetic. They include shellac, casein, nitro-cellulose, cellulose acetate, styrol, glyptal, and vinyl resins, and many others. Most of these are thermo-plastic materials, which soften under heat and can be molded and remolded. These find their primary applications where beautiful coloration is a factor, although some have exceptional dielectric properties.

Shellac, usually mixed with mica, is an excellent dielectric and is extensively used for high-tension insulators. It is easy to mold, but softens in its common forms at temperatures of about 120 to 170 degrees F. Recent developments have greatly improved its heat resistance.

Casein, a milk by-product, is not well adapted to molding, but is available in rod, tube, and sheet form for machining into different shapes. It machines quite freely and is readily given many bright colors by dyeing. This material is sometimes sold as artificial horn, and is extensively used for making buttons for garments. It is somewhat hygroscopic, but is occasionally used for dielectric purposes. Trade names include Erinoid and Colasta.

The Cellulose Group of Plastics

Nitro-cellulose or pyroxylin plastics are extensively used for decorative purposes, chiefly as machined from sheet, rod, or tube forms, but molding is readily done and thin sheets are often formed or "blown" into toys and useful articles. Nitro-cellulose plastics machine freely, but care must be taken to avoid the accumulation and ignition of chips, as the material is highly combustible and even explosive.

It is available in a wide variety of transparent, translucent, and opaque forms, many of which are of great beauty. Fountain pen barrels and a great variety of toilet and ornamental articles are made from this material. It softens at quite low temperatures and is often softened for working by immersion in hot water. It is also softened so that it can be stretched for covering or veneering articles, by dipping in a mixture of water and acetone. It is readily joined by cementing. Commercial forms include Celluloid, Pyralin and Amerith.

Cellulose acetate is quite similar to cellulose nitrate (pyroxylin) in appearance and physical properties. Although it is combustible, it does not burn rapidly or explosively, and so is frequently used in place of nitro-cellulose to avoid the hazards involved in the use of the latter. The acetate has excellent dielectric properties and very low water absorption; hence it is an excellent (although a rather expensive) insulator.

It is extensively used for the molding of decorative articles and is available in a wide variety of beautiful plain and mottled color effects. It is available in various grades of hardness, the harder grades being quite heat resistant up to about 400 degrees F., whereas the softer grades become very soft at temperatures approximating 270 degrees F. Molding is usually done at temperatures of 275 to

365 degrees F., and in some instances, the acetate is softened outside the mold and injected in plastic form into the mold cavity under high pressure. The machining qualities are fair to good. The colors available are almost unlimited in number. The trade names of cellulose acetate include Lumarith and Masuron.

Styrol plastics, although resembling cellulose acetate in general appearance, are entirely different chemically and differ also in physical properties. Meta-styrol is one of the best dielectrics known, being, according to some authorities, superior even to natural amber and quartz. It is also extremely resistant to moisture absorption, being reported to have, in fact, practically zero absorption; hence it maintains its dielectric qualities exceptionally well.

It is quite easily softened by heat and is reported subject to cold flow, that is, to distortion when stressed under normal temperatures. It is molded at a pressure of 500 pounds per square inch at a temperature of about 300 degrees F. This is a relatively new type of plastic and is comparatively expensive because of small production, but the makers indicate that if the demand increases sufficiently to require large production, a material decrease in price is possible.

Vinyl plastics, although long available in limited quantities, are now being introduced on a larger scale. In general appearance and variety of color, they resemble cellulose acetate, and, like it, are true thermo-plastics, although their softening point is lower. They soften at 120 to 160 degrees F., and tend to darken when subjected to temperatures above 150 degrees F. They have good flowing and molding qualities and are available in transparent, translucent, and opaque form, and in a wide variety of bright colors. The machining qualities are good and the dielectric properties excellent. Molding temperatures vary from 115 to 150 degrees F., and the pressures recommended are from 250 to 2000 pounds per square inch. The commercial forms of vinyl resins are sold as Vinylite.

Glyptal resins, although moldable, are not generally considered molding materials because of the long cure required. They are used most widely as resins in the formulation of finishes, but can be had in cast form, in attractive colors, for machining into saleable items, such as pen and pencil barrels.

Industry Planning—the Next Step

By JOHN F. SHERMAN, President
National Industrial Advisory Corporation, New York

AS the program for industrial recovery assumes definite form through the process of public hearings on codes and the subsequent approval of specific codes by the President of the United States, it becomes increasingly evident that the remedy for the economic ills of our industries, individually and collectively, is industry planning.

By industry planning is meant the adoption of methods that will aid a particular industry in promoting the proper coordination of production and consumption, to the end that an orderly and progressive business life within that industry, and the best possible relationships with other industries, may be developed.

It is generally conceded that the primary cause of the business depression was the woeful lack of balance between the goods produced and the ability of the public to consume. The need for economic planning was early recognized by the Recovery Administration. The cotton textile industry also showed its recognition of this need by writing into its code (the first in all industry to be approved) the establishment of a "Planning and Fair Practice Agency." The duties of the agency, as stated in the code, are to assist the Recovery Administration in promoting the keeping of uniform accounts in the industry; in promoting the proper balance between production and consumption; in stabilizing industry and employment; and in setting up a service bureau for engineering, accounting, credit, and other purposes.

One of the very reliable Washington news-reporting agencies refers to this feature of the Cotton Code as representing "the government's first step in the direction of setting up a *national program of economic planning*. Eventually this intra-industry economic planning will be coordinated with nation-wide plans for better control of production and distribution."

Already many important industries have followed the lead of the cotton industry, arranging through their codes to set up planning and coordinating committees. Every industry that hopes to share in the full benefits of the Recovery Act must do the same thing sooner or later.

An industry that hopes to get the full benefit of the recovery program must arrange to tie in with the trend toward economic planning. If it does not do so, it may find itself "squeezed" between industries more forward-looking and aggressive, which in the process of looking out for their own futures may inadvertently do damage to some related or dependent industry.

An industry-planning program calls for the application of the same experience and knowledge to the problems of an *industry* that have been used

heretofore by *individual companies* in plotting their separate futures. Planning by an individual company to regulate production and employment by scientific budgeting and forecasting of sales and production has been demonstrated as practicable and valuable to the company, as well as to its employes. Certainly trade associations, with the opportunities now afforded for cooperative action, should find it profitable to analyze their industries to determine desirable financial, production, merchandising, and budgetary policies for the industry as a whole.

Industry Planning Must be Based on Statistics

Comprehensive, dependable statistics are indispensable to the beginning of industry planning. It is absolutely essential to know the past and the present in order to project plans into the future. This involves securing data for a past period and compiling current data according to the problems of a particular business.

Without a statistical program, the elimination of destructive competition might be so difficult as to be impossible of accomplishment. With such a program, not only the industry but those governmental agencies given the responsibility of administering the Recovery Act and also the representatives of labor will be able to deal intelligently with the problems of any particular industry. The new thinking underlying the recovery program calls for the marshalling of significant facts and their interpretation and interchange to the end that management, labor, and the government may coordinate their efforts to improve the condition of any particular industry and of business in general.

The First Step is a Distribution Survey

No industry planning job should be attempted without a thorough distribution survey. In making such a survey, the purpose should be to "start from scratch," ignoring all precedent, tradition, and sentiment until a cold-blooded, detached study of the industry and its distribution methods shall have shown whether or not existing conditions are economically sound for the long pull.

It is possible to set an objective for the industry two, five, or ten years in the future and control the expansion or contraction of the industry to a very satisfactory degree. Such a task involves consideration of buying trends; productive capacity; traffic studies; sales promotional campaigns planned for the long pull; scientific studies of new product and new market possibilities; defense against the poaching or competition of other industries; product improvement and technical research; sounder credit structure; industry's direct dependence upon some other industry (as the dependence of the tire business upon the automobile); orderly disposal of surplus stocks; definite allocation or rationing of business by zones or otherwise; conservative and intelligent control of production; elimination of unfair trade practices; or, it may be any one of a dozen other solutions which cannot be determined until a scientific study of the industry has isolated the problem.

* * *

Skin Protection in the Mechanical Industries

A new skin-protective cream suitable for use in machine shops has been brought out by the Magnus Chemical Co., Inc., Garwood, N. J., under the trade name "Skin-Gard." This protective cream, when rubbed on the hands before starting work, will keep the surface of the hands practically free from oil and grease—in other words, ordinary washing of the hands protected by this material will completely remove all grease and dirt without difficulty.

* * *

New Type Conduit for Underground Service

A new type of conduit designed to meet the very rigid requirements of underground electrical service has been developed by the Goodyear Tire & Rubber Co., based upon several years of exhaustive research and experimentation. The new conduit has high resistance to water absorption and marked fire resistance. It has also unusually high impact and crushing strength, even at very low temperatures. Again, at extremely high temperatures, the conduit does not exude oils or impregnating compounds.

Mobile Yaw Winch Chassis with Welded Frame Built by the Wellman Engineering Co. for the Navy Department's Lakehurst Air Station

EDITORIAL COMMENT

An Opportunity for Industry to Become Its Own Boss

The most important industrial news of the month affecting all industry is the proposal of Gerard Swope, president of the General Electric Co., to so modify the activities of the National Recovery Administration that industry will be completely organized to handle its own problems. There has been an increasing realization of the difficulties incident to carrying out the NRA program along the lines followed since its inauguration. The new plan, which deserves to receive the whole-hearted approval of the President, would eliminate the interference with industry that has been much complained of.

Just as the time comes in the political growth of a nation when each community must be organized and coordinated with all other communities, in order that an effective government may be created, so the time has now come in the industrial field when there must be organization and coordination on a national scale; and yet, this coordinated organization can be made truly self-governing, if industry so chooses. This plan may not be perfect; but the step is in the direction of progress and should silence many of the complaints recently raised against the tendency toward bureaucratic governmental control.

It has been the traditional policy of the government of the United States to leave the citizens and groups of citizens alone in their pursuits whenever they have proved that they are able to conduct themselves in accordance with the public interest and welfare. And so, organized industry, capable of conducting its own affairs, will be in a position calling for little or no governmental interference. The proposed National Chamber of Commerce and Industry may some day become one of our most important national institutions. It is to be hoped that it will not be opposed by any group seeking only its own advantage.

The Russian Idea of the High-Production Machine

In Russia the working people support to the utmost the policy of their government in buying and installing high-production, labor-saving machinery in order that the standard of living of the Russian people may be raised to that of the level of the United States. In the United States, on the other hand, there are people who decry the use of modern, efficient machinery. If these people were able to carry their ideas to a logical conclusion, they would—by refusing to use machinery—reduce the high standard of living here to that prevailing in Russia.

Whatever else we may think about the Soviet conception of government and economics, we must admit that when it comes to recognizing the value of modern, high-production machinery, the Russians are ahead of many of the people in this country. Nowhere in the world has the physical comfort of the average man been so well provided for as in the United States, and back of it all is the modern machine; but that fact those who fear the machine are unable to see.

Correct Tool Grinding Methods Pay Handsome Dividends

Antiquated tool and cutter grinding equipment is frequently found in shops otherwise provided with modern tools. Apparently when the plant is busy, no one thinks of anything but production machines—accessories such as tool and cutter grinding equipment being considered of secondary importance; and when business is not very active, tool grinding machines are not required, so that little attention is given to them.

However, this is a good time to give some thought to tool grinding requirements. The obsolete equipment so frequently found in the shop consumes too much time and labor, besides making it impossible to grind most tools properly. The correct grinding of tools is one of the cheapest means available for increasing production.

An authority in the tool and cutter grinding field recently said that the average plant could increase production 20 per cent by substituting the best tool grinding methods for ordinary procedure. While this figure may be too high, an increase only half of that would be remarkable, because obtained by a comparatively small expenditure. Compared with production machines, tool and cutter grinding equipment is inexpensive.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Adjustable Stroke-Feeding Mechanism for Sewing Machines

By E. K. LLOYD

The feeding mechanisms of sewing machines used for commercial production work must be designed to handle a great variety of fabrics. This requires a wide range of adjustment in the length of stitch. The mechanism must be substantial and as simple as possible. The parts must be so proportioned that they will be durable and require a minimum of power for their operation. While the method of adjusting the length of stitch should be simple and positive, it need not be of a character suitable for adjustment by the operators.

Referring to the feed-dog shown at *B* in the accompanying illustrations, it is necessary that the path of travel of this part while above the throat plate *N* in the working part of its cycle of motion be approximately a straight line. It is also desirable that the working path of the feed-dog be capable of being tilted in either direction from a line parallel with the top of the throat plate. The mechan-

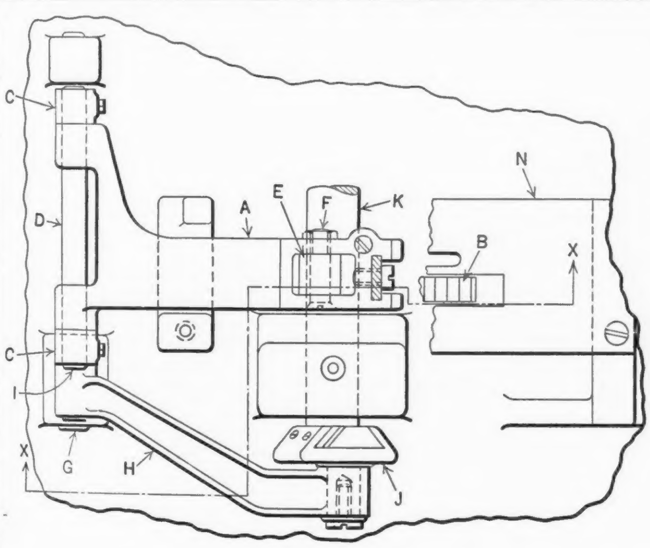


FIG. 1

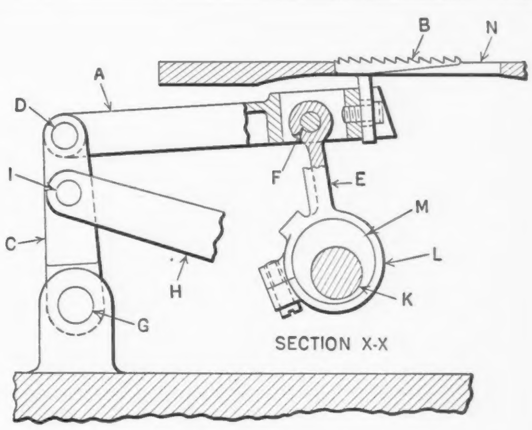


FIG. 3

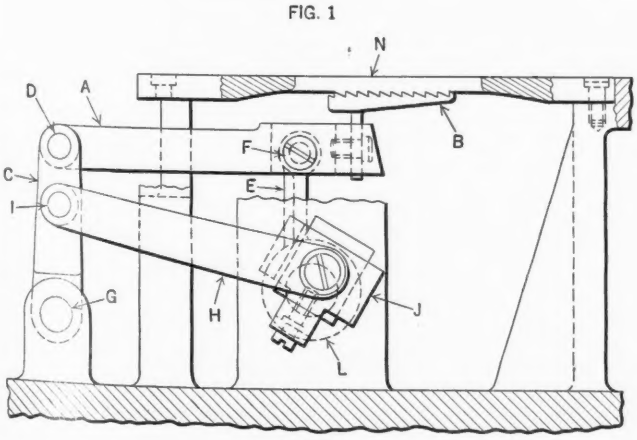
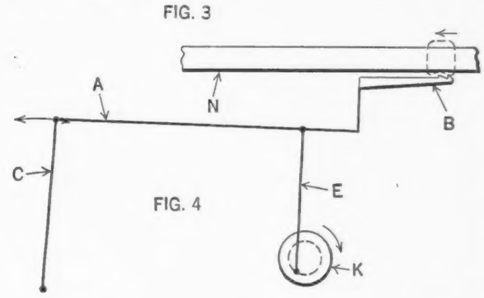


FIG. 2



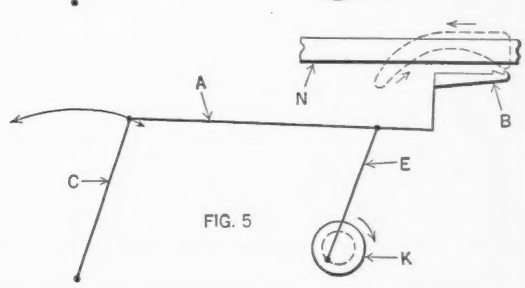


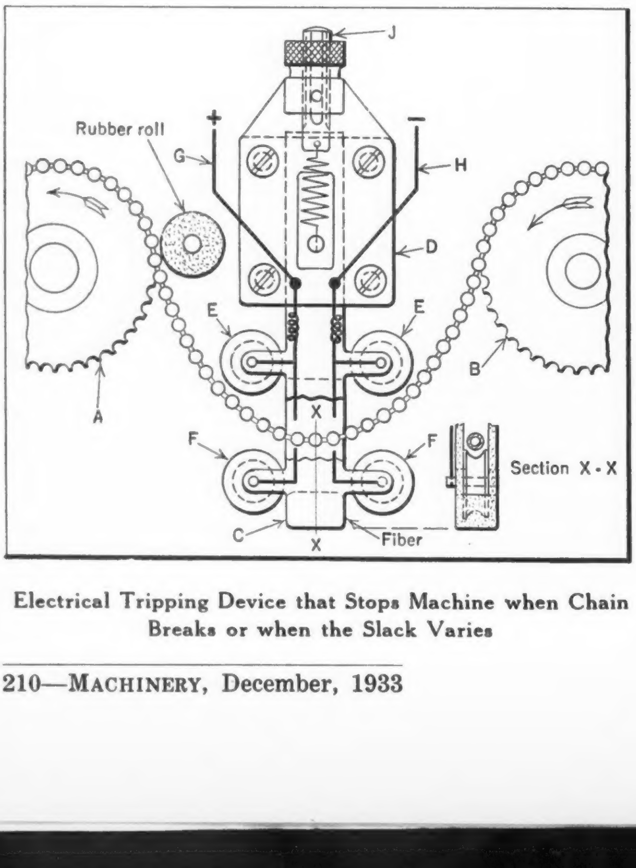
Fig. 1. Plan View of Feeding Mechanism for Sewing Machine. Fig. 2. End View of Mechanism Shown in Fig. 1. Fig. 3. Section X-X of Fig. 1. Fig. 4. Diagram Showing Adjustment for Short Feeding Stroke. Fig. 5. Diagram Showing Adjustment for Long Feeding Stroke

ism shown in Figs. 1, 2, and 3 accomplishes these several objects in the manner to be described. The same reference letters are used to designate the parts in the several views.

The feed-dog *B* is attached at or near the front end of the feed-bar *A*. The rear end of this feed-bar is supported by rocker arm *C* by means of shaft *D*, about which it is free to pivot. In a similar manner, the front end of the feed-bar is carried by rocker arm *E*, which is free to pivot about the pin connection *F*. The rear rocker arm *C* is pivoted at its lower end to the frame of the machine at *G* and is driven by link *H*. Link *H* is pivoted to arm *C* at bearing *I*.

The other end of link *H* is pivoted to the adjustable feed-crank *J*, carried on the end of main shaft *K*. The lower end of rocker arm *E* is in the form of an eccentric strap *L*, which engages eccentric *M*, driven by the main shaft *K*. This eccentric is termed the "feed-lift eccentric." Both the feed and lift motions are positive, and their combined action on the feed-dog results in a path of motion relative to the throat plate *N* such as is illustrated by the dotted lines in Figs. 4 and 5.

This arrangement causes the rear end of feed-bar *A* to rise and fall twice with each revolution of the shaft *K*. The amount of this rise and fall depends upon the length of the rocker arm and its angular displacement each side of the vertical position. In a like manner, the front end of the feed-bar will rise and fall, due to the relation between it and the front rocker arm. The front end of the feed-bar is also caused to rise and fall by the rotation of the lift-eccentric on the main shaft. It is evident, therefore, that the rise and fall of the front end of the feed-bar will be the result of these two actions. The rise and fall of the feed-dog will be similar to that of the front end of the feed-bar, but not exactly the same, depending upon its size and location relative to the front end of the feed-bar.



Electrical Tripping Device that Stops Machine when Chain Breaks or when the Slack Varies

The diagram Fig. 4 shows the adjustment for a relatively short stitch, and the diagram Fig. 5, the adjustment for a relatively long stitch. These views indicate the relationship between the rocker arms, feed-bar, feed-dog, throat plate, and lift-eccentric. The dotted lines in these illustrations show roughly the path of the toe of the feed-dog. The path of the heel would be similar to that of the toe, but not exactly the same.

By a suitable proportioning of the parts and adjustment of the angular relationship between the feed-crank and the lift-eccentric, the feed-dog may be caused to emerge through the throat plate parallel to the latter member and to travel a very nearly straight line parallel with the top of the throat plate.

By altering the angular relationship between the feed-crank and the lift-eccentric, the feed-dog may be caused to emerge from the throat plate, toe first, that is, the feed-dog may be tilted backward at a slight angle. By changing this angular relationship in the opposite direction, the heel of the feed-dog may be caused to rise first. These various relations of feed-dog to throat plate are desirable because of the feeding requirements of different kinds of fabrics and the kind of seam required. In the design described, excessive wear and violent velocity changes have been avoided. This enables the mechanism to be operated at high speeds with relatively small wear and with a comparatively small consumption of power.

Tripping Device for Bead-Chain Cutting-Off Machine

By J. E. FENNO

Bead chain made of brass is used in large quantities for electric-light pull-sockets. This chain is wound on spools in bead-chain forming machines and then delivered to other machines where it is cut off to the required length for assembly in the sockets. In the cutting-off machines, the chain is passed over two sprockets *A* and *B*, as shown in the illustration. Creeping of the chain on the sprockets is one of the major troubles experienced with these machines; and if the machine continues running after creeping occurs, mutilation of the chain in another part of the machine results.

It was found that this difficulty could be overcome by maintaining a certain amount of slack between the sprockets; and to obtain this condition, the tripping arrangement shown was incorporated in the machine. The tripping mechanism is so arranged that if the slack becomes appreciably greater or less than that indicated, the chain closes the electric circuit of a solenoid. This causes the core of the solenoid to release a clutch which stops the machine. The operator then gives the chain the required amount of slack.

One of the advantages of this type of tripping device is that the chain is not required to lift or support any weighted latch member in order to close the circuit; the chain itself closes the circuit. In addition to this, if the chain breaks, the circuit is also closed, causing the solenoid to stop the machine.

The tripping arrangement consists chiefly of the fiber slide *C*, which is guided in the stationary block *D*. On the slide are mounted two sets of rolls *E* and *F*. At the end of the small pins on which the rolls turn, copper wires are soldered. These wires are connected to the two main wires *G* and *H* leading to the solenoid (not shown).

It will be noted that slide *C* has a floating action, its weight being supported by the spring attached to screw *J*. This prevents excessive pressure of the upper rolls on the chain. Screw *J* can be adjusted so that the chain is normally half way between the upper and lower sets of rolls. The slide is made from fiber in order to insulate it from the machine, and the machine is separated from its foundation by layers of insulation to prevent grounding of the current.

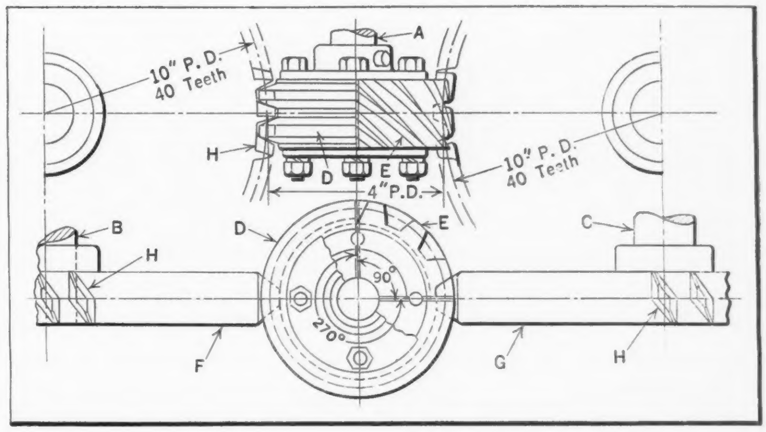
The action of the device is as follows: If the chain creeps forward on sprocket *B*, the slack will increase until the chain rests on rolls *F*. This closes the circuit formed by wires *G* and *H* and operates the solenoid, which, in turn, releases the clutch and stops the machine. If the creeping of the chain is such that the slack is reduced, a similar action of the solenoid occurs, the chain being drawn against rolls *E*, in this case, and thus closing the circuit.

Gear Drive for Intermittent Motion

By GEORGE SIROTKIN

In designing a transformer tap changer, provision had to be made for alternately moving the arms of two tap adjusters with a dwell between each movement. Also the arms were required to be locked between movements. It was desirable to have the driving shaft at right angles to the shafts that operated the tap adjuster arms. The speed reduction was required to be approximately 1 to 12.

These conditions were fulfilled by the mechanism shown in the accompanying illustration. The gear drive consists of a combination worm on the driving shaft *A* which meshes with two gears on the shafts *B* and *C* connected to the tap adjusters. The worm is built of two parts *D* and *E*. Part *D* has tooth spaces that appear simply like annular grooves. This part comprises a segment of 270 degrees. The other part *E* has a helix angle of 53.1 degrees. These two parts have grooves in their sides into which annular ribs on the side plates fit when the four members are bolted together as shown.



Gear Drive with Special Gears Designed to Have Shaft A Drive Shafts B and C Intermittently

The two gears *F* and *G* are alternately in mesh with both parts *D* and *E* of the worm. This is accomplished by making gears *F* and *G* with teeth, as indicated at *H*, which will mesh with the teeth in both section *D* and section *E* of the driving worm. When the teeth in *F* and *G* are in mesh with the teeth in section *D*, no motion is transmitted from the driving to the driven shaft. One rotation of segment *E* past *F* or *G* serves to rotate either one of these gears through an angle of 27 degrees. The gears *F* and *G* each have 40 teeth. The section *E* is a 90-degree segment of a 12-thread worm. With this arrangement, gear *F* and then gear *G* will be turned through an angle of 27 degrees. There is a stop or dwell between each movement corresponding to three-fourths revolution of the driving shaft. Both pinions are locked between their respective rotational movements.

* * *

Richard Trevithick, Engineering Pioneer

The story of the life of Trevithick, the centenary of whose death is commemorated this year, recalls a very important chapter in the history of engineering. When he was born, in 1771, the tide of the mechanical revolution was barely discernible; when he died, it was in full flood. His age saw the rise of modern civil engineering, the birth of mechanical engineering, and the application of mechanical invention on an extended scale to practically every important industry. It was an age of pioneers, of which he was one of the foremost. His life, too, coincided with a period of vast social, economic, and political development. He was born two years after Watt secured his first great steam engine patent, and he died three years after the opening of the Liverpool and Manchester Railway. In his lifetime, Trevithick saw the application first of cast iron, and then of wrought iron, to structures and machines; and the production in large quantities of wrought-iron bars, rails, and plates. He likewise witnessed the birth of the boring mill, the self-acting lathe, and the planing machine.—*Engineering*

Getting Best Results from Chromium-Plated Cutting Tools

How Chromium Plating is being Used to Increase the Durability and Improve the Cutting Efficiency of Turning and Planing Tools, Drills, Reamers, and Files

By CHARLES F. BONNET, Metallurgical Engineer, The Chromium Engineering Co. Philadelphia, Pa.

THE successful use of chromium-plated tools depends in a large measure on a thorough understanding of their proper design and operation. The object of the present article is to clarify some general impressions regarding the action of chromium-plated tools and to describe the best shop practice in their use.

The general impression that chromium, due to its hardness, adds to the actual hardness of the cutting edge is erroneous. Experience has shown that chromium does not materially increase the hardness of cutting edges, but it does increase the durability of a cutting edge to a decided extent and also improves the cutting efficiency of the tool.

Advantages of Chromium Plating Due to High Surface Tension

The increased durability and improved efficiency of chromium-plated tools may be shown to be due chiefly to the high "surface energy" of chromium. High surface energy means simply that the atoms in a chromium metal surface have such a strong attraction for each other that they have a minimum attraction for the atoms of other materials. In other words, a chromium-plated surface has a strong skin formed by the attraction between the exposed atoms. It is extremely difficult to tear these atoms apart or for other atoms to penetrate them.

When the more common metals, such as iron, copper, brass, or steel, the surface energy of which is much lower than that of chromium, are rubbed together under heavy pressures without lubrication, seizing and wiping occur. This is because the two metals are in such intimate contact that the atoms in each attract and become attracted to those in the other. The result is what we call "seizing," and while it is not always evident, the seizing of minute particles is the actual cause of most cases of metal wear.

An analysis of the action of metal cutting edges shows that in a properly dressed tool, the failure of the edges is due to the heating and abrasive effect on a small area along the edge caused by the rubbing of the chip. Metal chips are continually being sheared away from the body of the work by the wedge-like edge of the tool. The chip then begins to curl as it slides along the "top" or "front" face of the tool, as shown in Fig. 1. Pressures both at the actual shearing edge and along part of the "front" face of the tool are very great.

The line of the cutting edge has a practically negligible area and a majority of the heating and abrasive effects are set up on that part of the face where the chip is curled, broken, and carried away. On this face we have the conditions of high unit pressures and intimate contact between materials that are characteristic of a wearing condition. As a result, seizure between the two metals is inevitable. Minute particles of the stock penetrate the tool and the stock, in turn, is penetrated by small particles of tool steel.

Very soft metals, such as aluminum, will accumulate on the face of the tool and may eventually foul the edge, while chips of harder metals carry away an appreciable number of tool-steel particles embedded in them. In either case, the failure of the edge is caused primarily by seizure taking place

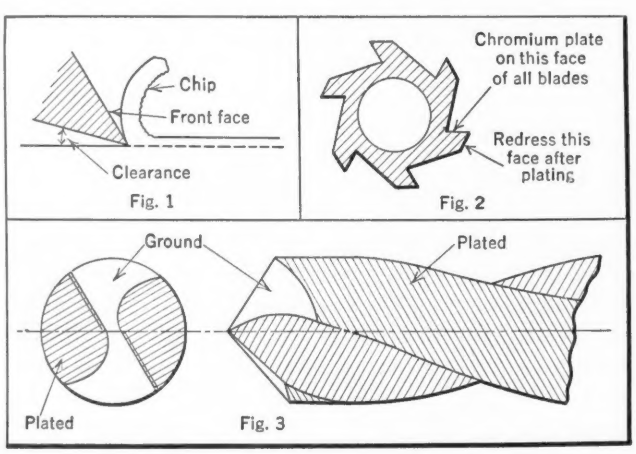


Fig. 1. Diagram Showing How Curling Chip Develops Abrasive and Heating Effect on Front Face of Tool. Fig. 2. Cross-section of Reamer with Teeth Properly Plated and Ground. Fig. 3. Twist Drill with Plated Surfaces Indicated by Shading

at the point of contact between the two metal surfaces.

Another important factor is the heating of the tool, which is due to the frictional resistance between the two metals, or more specifically, to the attraction that is set up between the two metals at the moment seizure begins. The effect of the heat is to anneal the edge of the metal, thus decreasing its resistance to deformation. Heating will also increase molecular activity and tend to promote seizing.

Chromium Possesses Self-Lubricating Property

The principal method of preventing wear of tool edges is through the use of cutting compounds. Chromium, due to its surface energy properties combined with its properties as a metal, is, in a way, self-lubricating and hence serves to increase tool life. Our experience has shown that the value of chromium plating may be summarized as follows: The chromium provides a partially lubricated surface on the tool at all times, supplementing the external lubrication which is being continuously wiped off. The hardness of chromium prevents the wear and consequent rapid removal of this permanent lubricant.

This should not be taken to mean that cutting lubricants can be eliminated by the use of chromium plating, but it does mean that chromium-plated tools are more efficiently lubricated than unplated ones and that the service required of external lubricants is less severe. In machining hard metals, the effect is to prevent the removal of tool metal, while in working soft metals, the fouling of edges is prevented or decidedly reduced. Also, tearing of soft metals is prevented and better finishes obtained because of freer chip removal.

The amount of heating is reduced, due to lowered friction, but the necessity for lubrication is not eliminated, because the chromium is softened by high temperatures, and hardness must be maintained, so that the chromium will be strong enough to remain in place for the maximum time.

Preparation of Tools for Plating

Most tools need only be plated once, as sharpening by grinding merely carries the edge back to fresh chromium on the chip bearing face. Before describing specific examples of plating on tools, a word regarding the preparation of tools for plating is in order. The only general requirement, but one of paramount importance, is that the tool faces to which chromium is to be applied be ground to as fine a finish as can be obtained and as far back from the edge as seems advisable in view of the service expected. Shanks should be clean and free from scale, but other parts of the tool may be allowed to remain covered with hardening scale or paint without harmful effect.

In order to secure a more complete understanding of the best practice in chromium-plating shop tools, we will consider the more common types and describe the application of chromium to them in detail. Success depends essentially upon the proper treatment of the "front" and "back" faces of the cutting edge.

Application of Chromium Plating to Twist Drills

Twist drills are chromium-plated over their full length. Provision must be made for adequate deposition in the flutes by proper adjustment of the bath temperature and the current while plating. In placing the drill in service, the point is dressed lightly to true up the edge, to remove the chromium, and to provide proper clearance on the back faces, as shown in Fig. 3.

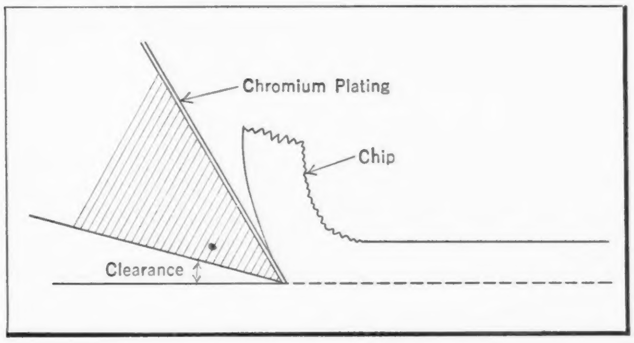


Fig. 4. Diagram Indicating Cutting Action of Tool with Front Face Chromium Plated

The main benefit is secured by the plating in the flutes, which surfaces comprise the "front" faces of the cutting edges. Some advantage may also be realized from the decreased friction on the outer edge of the twist, through lessening of the tendency to stick or "freeze" in the hole being drilled. Only a relatively thin plate is necessary, and drills will not become appreciably over-size due to plating. Sharpening has the effect only of exposing fresh chromium, and one plating will last the life of the tool.

Treatment Applied to Reamers

For common straight- and spiral-fluted reamers the procedure in applying chromium plating is quite similar to that for twist drills, except that the "back" face now follows all the way up the tool on the outside of each blade. The relief of this "back" face by dressing to provide proper clearance and the removal of chromium from it, as indicated in Fig. 2, is essential to the satisfactory operation of the plated reamer. It is often advisable not to finish a reamer to the final dimension until after plating.

The foregoing procedure also holds good for other types of reamers. Blades can be removed from

the inserted-blade type of tool and plated separately at low cost, or if desired, the entire tool, with blades in place, can be plated. Plating the blades alone will generally be found more satisfactory. In either case, the "back" faces must be dressed after plating, as described.

Restoring Worn Reamers to Size by Plating

Quite different from the practice described is another type of application of chromium plating to reamers, namely, the reclamation of worn reamers by a heavy deposit of chromium. In such a case, a heavy deposit of chromium is applied, so that the diameter becomes somewhat greater than that required. The tool is then dressed to size. Now the entire edge is composed of chromium. The "back" face is ground for clearance, as shown in Fig. 2, but the chromium will not all be removed. It is possible that after heavy deposition, the "front" face may require dressing, so that it will be smooth enough to carry chips freely. Since the entire edge is of chromium, which is quite brittle and of low shock resistance, only the more easily worked types of metals should be machined with the reclaimed tool.

For ordinary use, taps are plated lightly and placed in service without dressing. Free operation and better lubrication result. In some operations, superior results are obtained by dressing the threads after plating, so that a slight clearance is carried back from the cutting edge.

Applications to Milling Cutters and Lathe Tools

The "back" faces of chromium-plated milling cutter teeth should be dressed after plating similarly to the blades of a reamer. Redressing of this face will sharpen the tool and expose fresh chromium, so that one plating will be sufficient for full life. Chromium plating applied to the "front" face of lathe and planer tools, as indicated in Fig. 4, has proved of decided advantage, particularly in machining soft metals. Dressing is necessary, as in other cases.

Files are, of course, never redressed after plating. Chromium plating has been found to increase their life substantially, however, due to the freer removal of chips, easier cleaning, and the longer life of the points resulting from this treatment. The chromium plating eliminates the use of chalk or other lubricants of this kind, such as are commonly applied to files, and serves as the only lubricant required.

The examples given serve to outline the generally accepted shop practice in the use of chromium-plated tools. Another requirement for the successful application of chromium to tools is that the plating procedure be carried out with sufficient care and technical skill to insure a deposit of high quality chromium metal where it is required. It is well known that the quality of chromium deposits varies widely. Close control of the bath temperature and plating current is necessary for good results, and it is only with a good plating job that good shop results can be secured.

* * *

The Development of Efficient and Satisfactory Truck Wheels

In referring to the historical development of wheels, and especially the design of modern wheels for shop trucks, Leroy Metzgar, president of the Metzgar Co., Inc., Grand Rapids, Mich., calls attention to an interesting phase in the evolution of shop truck wheels. With the development of the cement industry, concrete floors were increasingly used in machine-building plants and factories in general. Since these floors were smooth and hard, they permitted greater speed in conveying materials on trucks. It was soon found, however, that metal wheels, being harder than the concrete, gradually wore holes in the concrete floors, thus making trucking difficult and causing considerable expense for the repair of the floors. Breakage of wheels was also a serious and expensive matter with heavily loaded trucks in "high-pressure" service.

Many of the larger plants, therefore, began to devote time and thought to a search for a wheel for trucks and trailers that would be able to support heavy loads without breaking, roll easily, be interchangeable, and at the same time save the floors.

To meet these requirements, many types of protective-tread wheels have been devised and many types of floor-protective wheels have been evolved, among which might be mentioned one unique development, the so-called "end-wood" wheel, which has unusual strength in proportion to its size and which obviates the wear on floors.

* * *

An Indication of Business Improvement

The General Electric Co., Schenectady, N. Y., has added 7600 employes to its force since March 1, and the total annual payroll of the company is today $17,000,000 greater than it was on that date. The new business booked in the first nine months of the year has shown a steady rise; for the first time since 1929, orders have exceeded those for a like period of the previous year. In other words, instead of going steadily downward, the business curve is steadily rising. Another significant fact is that this year, for the first time in three years, orders for the third quarter total more than sales billed in the same period. It is also stated that in conforming with the NRA electric manufacturers' code relative to hours of employment and wages, but little change was required in the company's method of operation, as the maximum work week since May 1, 1931, has been only forty hours, and very few employes have been paid at a lower rate than that prescribed by the Code.

Avoiding Early Obsolescence by the Use of Standard Machines

By CHARLES M. REESEY

High Obsolescence Costs May Often be Prevented by the Use of Standard Machines Equipped with Special Tooling Instead of Entirely Special Machines

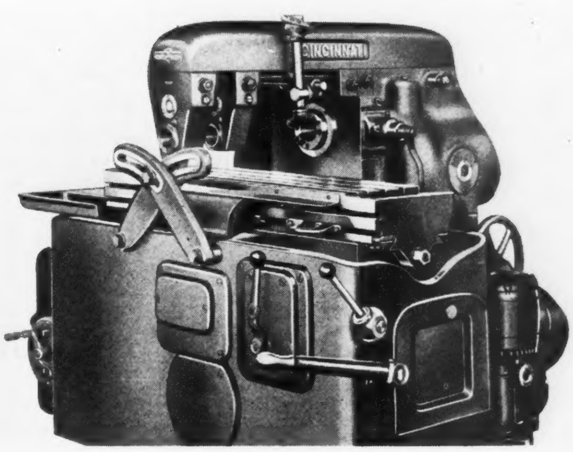


Fig. 1. Hydromatic Milling Machine of Standard Design which can be Readily Equipped with Fixtures and Tools for Performing Operations that Might Seem, Off Hand, to Require a Special Machine

SPECIAL machines are used frequently in mass production with a view to manufacturing at the lowest possible cost. With special machines, however, there is always a chance of early obsolescence, due to a change in the style or design of the product. If such a change makes the special machine of no further use, any production advantages obtained by the use of the machine are at least partially nullified. It is for this reason that manufacturers have found it necessary to charge off investments in special machines at anywhere from 50 to 100 per cent during the first year.

Sudden obsolescence of equipment can often be avoided by selecting a standard machine tool for a given job and fitting it with special tools and fixtures that will give production rates comparable to those obtainable with a special machine. Then, if important changes are made in the work, the machine itself can be readily adapted to some other operation, and only the tooling becomes obsolete.

Many standard machines today fulfill the requirements of mass production, because they are designed to operate automatically in cycles that can be altered conveniently and at feeds and speeds suitable for the different classes of work. Much time and money are sometimes spent in designing and testing a standard machine before it is introduced on the market. This development cost is spread over hundreds of machines and the user gets equipment that has been proved satisfactory.

Automatic high-production fixtures that will utilize the productivity of a standard machine to the utmost are, of course, expensive in themselves, but not nearly so expensive as a machine that is special throughout. Fixtures must carry a high obsolescence charge, perhaps 50 per cent for the first year or even 100 per cent. However, a depreciation charge of 10 per cent on the machine itself is conservative, with perhaps an extra 5 per cent to guard against obsolescence due to important engineering advances in the type of machine used.

Suppose, for example, that a standard machine equipped to produce a given quantity of work costs \$6000—\$3000 for the machine and \$3000 for the fixture. Then the yearly charges would be:

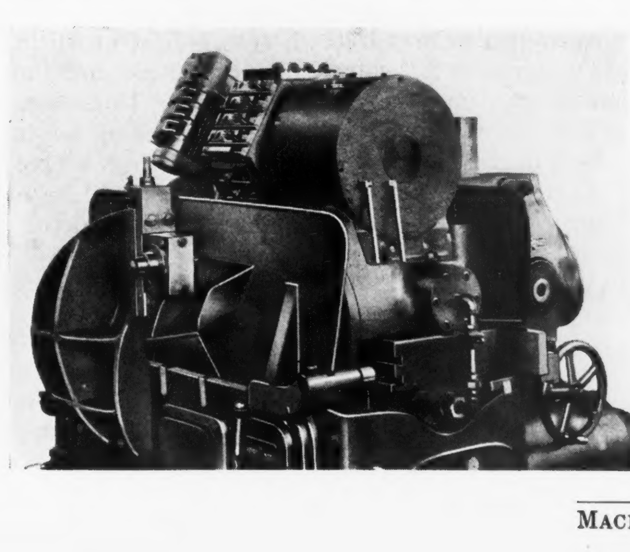


Fig. 2. How the Machine Shown in Fig. 1 was Adapted for the Mass Production of Automobile Brake-shafts. Changed Design Would Make Only Fixtures and Tools Obsolete

Machine: 15 per cent of $3000	=	$450
Fixture: 50 per cent of $3000	=	$1500
Total yearly charges	=	$1950

In all probability a special machine for doing the same work could not be built for $6000, but if it could be, the yearly charges would be at least 50 per cent of the total cost, or $3000.

The illustrations show how a standard machine like the Cincinnati Hydromatic milling machine can be equipped to do the work of a highly special machine. Fig. 1 shows the machine as regularly built, and Fig. 2 shows it provided with special tooling that enables it to form-mill one end of automobile brake-shafts at a continuous production of 880 pieces per hour, with only one operator. The six-sided drum-type fixture indexes automatically to bring the work pieces into line with the cutters, each side of the fixture holding four pieces. Clamps operate automatically to hold the work pieces for the operation. The table feed cycle is automatically controlled through dogs to bring the work to and from the cutters.

This equipment has all the advantages of a special machine, as it is fast, accurate, fully automatic, and does not require skilled labor for its operation. In addition, it has features not usually incorporated in a special machine, such as a controlled variable rate of feed during the milling cut. The most important point, however, is that if this particular job should be discontinued, the machine could be readily applied to some other work. It would not become obsolete.

Making Helical Springs According to A. S. T. M. Specifications

Standard specifications for heat-treated carbon-steel helical compression springs, made of round bars 1/2 inch and larger in diameter and suitable for use on railway equipment, have been adopted by the American Society for Testing Materials. The Society's publication "A 125-33" describes the procedure for manufacturing, sampling, testing, finishing, and marking this class of hot-coiled helical springs. The following paragraphs, together with the accompanying Data Sheets Nos. 263 and 264, will serve as a guide in the production and application of helical springs within the range of sizes specified in the Data Sheets.

The steel used in these springs can be made by one or more of the following processes: Open-hearth, crucible, or electric furnace. The rolled bars must be practically straight, free from surface cracks, rolling seams, folds, and flat areas or other injurious defects. The bars, after being suitably tapered or otherwise prepared, must be heated slowly and uniformly to a temperature of approximately 1700 degrees F. and coiled on a pre-heated mandrel. Care must be taken to see that water does not come in contact with the heated bar at any time.

After being coiled, the springs are allowed to cool uniformly to a distinct black heat. They must then be reheated uniformly to a temperature sufficient to refine the grain and quenched in oil. After being quenched, the springs must be allowed to cool to at least 400 degrees F. and then be reheated uniformly to a temperature below the critical point, but sufficiently high to give a proper drawback or tempering effect.

Unless otherwise specified, the steel should conform to the following requirements as to chemical composition: Carbon, 0.90 to 1.05 per cent; manganese, 0.25 to 0.50 per cent; phosphorus, 0.05 per cent, maximum; sulphur, 0.05 per cent, maximum; and silicon, 0.15 per cent, minimum.

The pitch of the coils must be uniform, so that when the springs are compressed to the point where any two coils are in contact, there will be no space exceeding 1/32 inch between the other coils, excluding the tapered ends. The diameter of springs up to 6 inches outside diameter must not vary more than 1/16 inch from that specified. For springs over 6 inches outside diameter and having a free height of 10 inches and under, the diameters must not vary more than 1/8 inch from that specified. The solid height must not be more than 1/16 inch over that specified, and the free height not more than 1/8 inch over the specified dimensions. The loaded height must not be more than 1/8 inch over or 1/16 inch under that specified. The permanent set must not be more than 1/32 inch. For springs having a free height of over 10 inches, but not over 15 inches, the tolerances given for springs having a free height of 10 inches and under shall be increased 50 per cent; and for springs having a free height over 15 inches, but not over 20 inches, the tolerances shall be increased 100 per cent. For springs having a free height over 20 inches, the tolerances should be mutually agreed upon by the manufacturer and the purchaser.

* * *

Almost 3500 tons of 3 per cent nickel-steel plate will be used to hold the cable eye bars on the new San Francisco-Oakland Bridge. This bridge, the largest in the world, will be 7 1/2 miles long, of which 5 miles will be over open water.

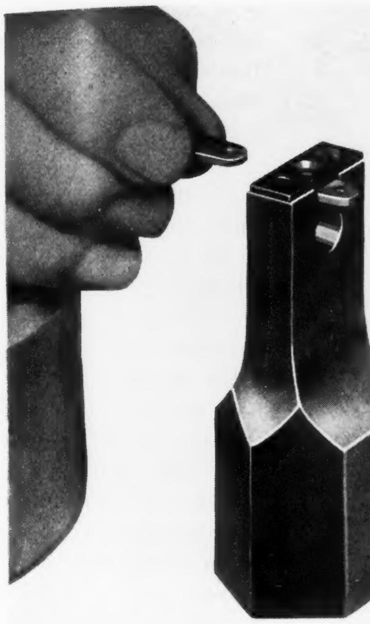


Fig. 1. Simple Push-through Fixture Used in Tapping Two Holes in Small Parts

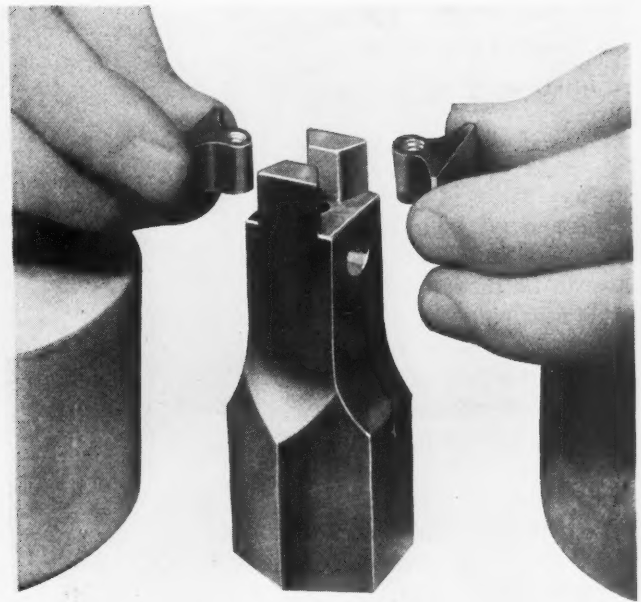


Fig. 2. Double-sided Fixture that Provides for Alternate Loading from Either Side

Fixtures for Tapping Small Parts at High Speed

By H. GOLDBERG
Vice-President
R. G. Haskins Co.
Chicago, Ill.

ONE of the most important factors in obtaining accuracy and high production rates in tapping holes in small parts is the design of the work-holding fixture. Production is dependent to a large degree on the speed at which the parts to be tapped can be presented to the tap, and likewise, on the speed with which they can be ejected after tapping. Accuracy requires proper means for aligning and holding the work. Of no less importance is the choice of the tap. The tap must not only be of the type most suitable for the material to be tapped, but it must be correctly sharpened. The height of the fixture, chip clearance, and location of the parts to be tapped are details that tend to increase production when properly worked out.

These and other important factors have been given careful consideration in the design of the various fixtures shown in the illustrations. The accompanying table contains some interesting data on the fixtures illustrated. While these fixtures were designed and built by the R. G. Haskins Co., Chicago, Ill., for specific tapping jobs on the high-speed tappers built by that company, the same principles of design are applicable to a great variety of similar work.

In tapping two holes in the small blank shown in Fig. 1, the pieces are fed into the slot from one side. After tapping the first hole, the piece is simply slid along into line for tapping the second hole. As soon as the tap-

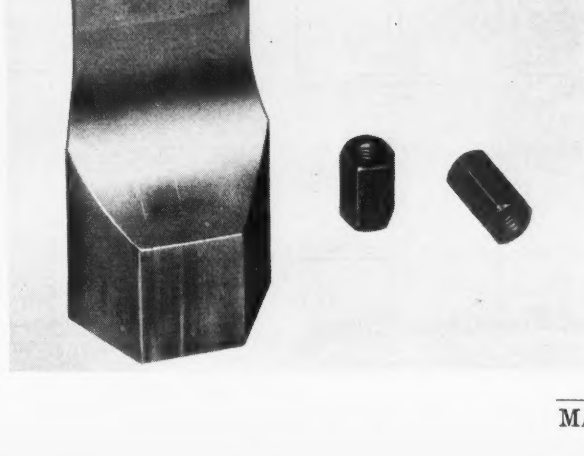
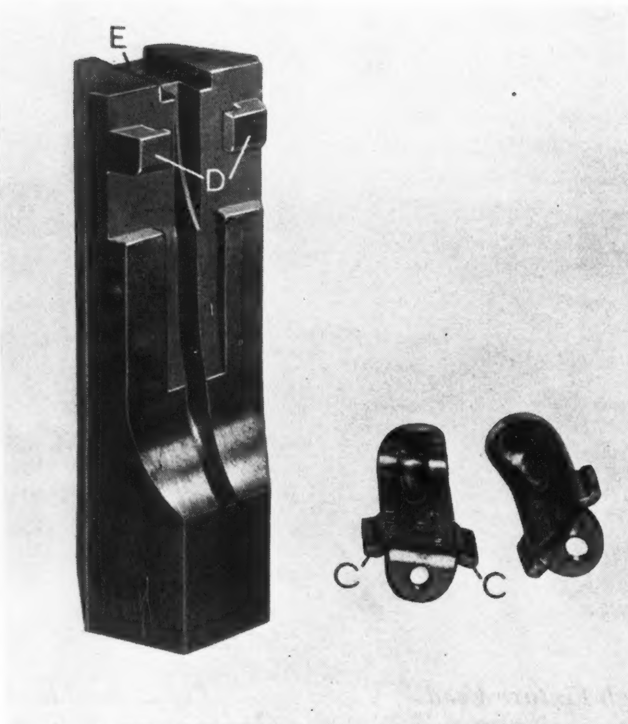


Fig. 3. Fixture with Automatic Knock-out for Tapping Hexagonal Nuts

Fig. 4. Fixture for Tapping Small Parts without Clamping



ping operation is begun on the second hole, another piece is picked up ready to be inserted into the fixture when the first piece has been completed. Insertion of the second blank pushes the tapped blank out into a work box.

The procedure is somewhat different in the case of the double-sided fixture shown in Fig. 2. With this fixture, the blanks are fed to the tapping position alternately from either side, the tapped blank being pushed out by the succeeding piece. For instance, a blank may be picked up with the right hand and placed in the opening of the fixture between the two guides; then, as soon as this piece is tapped, a blank held in the left hand is pushed into place from the opposite side, causing the tapped blank to be ejected. Thus the tapping operation is continuous, the piece being fed into place first by the right hand and then by the left hand.

The tapping of 3/8-inch brass nuts, 9/16 inch long, such as shown in Fig. 3, requires an efficient holding fixture in order to eliminate excessive tap breakage. The fixture illustrated has proved very satisfactory in this respect, and has more than doubled the production obtained with the equipment previously employed. The nut to be tapped is placed on the stud *B* against the extended side *F*, which serves as a guide for sliding the work into the opening against a stop. When the work is pressed into place, it causes the knock-out *D* to recede against the tension of the knock-out spring. The plate *E* prevents the blank

Data on High-Speed Tapping Operations Performed on Fixtures Shown in Figs. 1 to 8

View in which Fixture is Shown	Kind of Material Tapped	Size of Hole Tapped	Number of Holes per Piece	Kind of Tap Used	Speed of Tap, Revolutions per Minute		Production, Pieces per Hour	Cost of Fixture
					In	Out		
Fig. 1	1/16-inch Brass	6–32	2	2-flute H.S. gun	3000	6000	1500	$6.50
Fig. 2	Extruded Brass Rod	1/4–20	1	4-flute H.S.	3000	6000	2400	$8.00
Fig. 3	Hex. Brass Rod	6–32	1	3-flute H.S.	3000	6000	2200	$14.00
Fig. 4	C.R. Steel	10–32	1	2-flute H.S. gun	3000	6000	1450	$9.50
Fig. 5	C.R. Steel	8–32	3	2-flute H.S. gun	2300	4600	700	$9.50
Fig. 6	C.R. Steel	8–32	1	2-flute H.S. gun	2300	4600	1350	$7.50
Fig. 7	Zinc Die-casting	10–32	1	2-flute H.S. gun	3000	6000	1900	$6.00
Fig. 8	Brass Stamping	6–32 10–32	2	3-flute H.S.	3000	6000	1400	$8.00

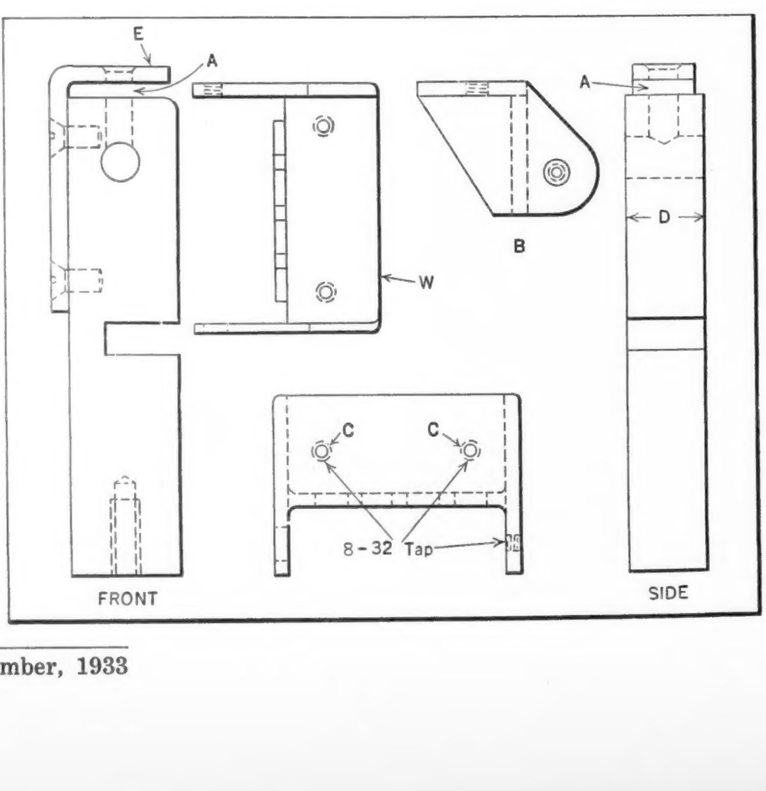


Fig. 5. Fixture for Tapping Three Holes in Two Different Positions in Steel Stamping

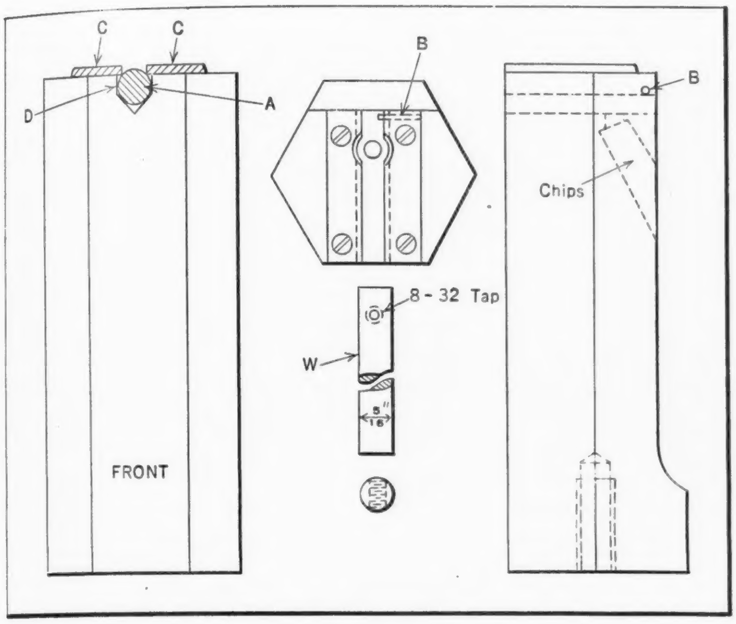


Fig. 6. Simple Fixture for Tapping Crosswise Holes in Round Cold-rolled Steel Rods W

from rising when the tap is reversed. The knock-out pin forces the blank out into a chute after the tapping operation has been completed.

The cold-rolled steel stamping tapped on the fixture shown in Fig. 4 is kept from twisting by having the ears *C* fit into slots in lugs *D*. Surface *E* acts as a stop for the portion to be tapped.

The simple fixture shown in Fig. 5 is designed to locate the peculiar shaped stamping *W* in two different positions for tapping three 8–32 threads. The blank is first placed in the opening of the fixture at *A* and tapped, after which it is removed and turned into the position indicated at *B* so that the two sides of the blank act as stops against the sides *D* of the fixture when tapping the two holes *C*. The piece *E* serves to prevent the work from rising when the tap is reversed.

The simple fixture shown in Fig. 6 is used for tapping the crosswise hole in the round cold-rolled steel piece *W*. The rod is simply placed in the V-opening at *A* against a stop-pin *B*. The stop-plates *C* prevent the rod from rising. The groove *D* serves to keep the rod parallel with the V-groove, as this opening is only 0.002 inch wider than the rod.

The double-sided tapping fixture shown in Fig. 7 permits the use of both hands in placing the work on the fixture from opposite sides. The die-casting *A* to be tapped is picked up with the right hand and placed in the opening *B*. Hub *C*, coming in contact with the side of the fixture *D*, serves as a stop. Groove *E* is provided for chip space and also for

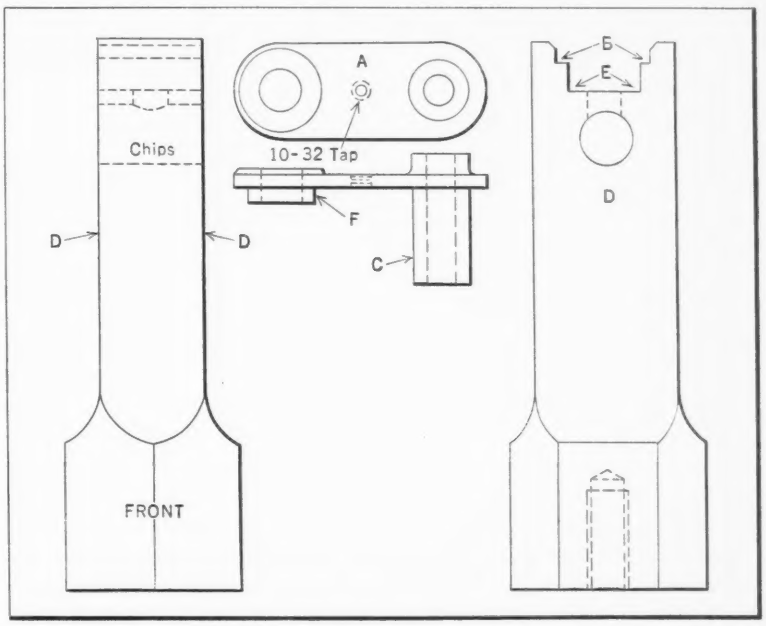


Fig. 7. (Right) Double-sided Tapping Fixture that Permits Use of Both Hands in Placing the Work, the Fixture being Loaded Alternately from Either Side

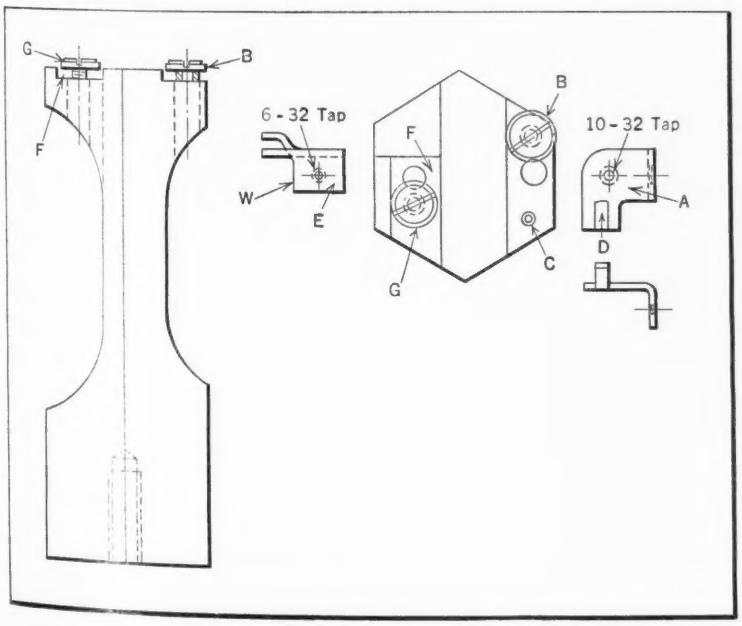


Fig. 8. Fixture Designed for Tapping Two Different Sizes of Holes in an Odd-shaped Part

Fig. 1. A Booth in the Museum of Science and Industry in Chicago Used for Demonstrating Electric Welding. The Welder Explains the Process as He Works, by Means of a Microphone and Loud Speakers

clearance for hub *F*. The feeding and locating operation is performed first with the right hand and then with the left hand.

The small odd-shaped stamping *W*, Fig. 8, having two different sized holes, is tapped on the simple fixture illustrated at the left. The first operation consists of tapping a 10–32 hole. For this operation, the blank is slid under screw *B*, where it is held in place by the pin *C* that fits into slot *D*. The screw-head *B* also acts as a stop and as a hold-down to prevent the blank from rising on the tap. After these holes are all tapped, the fixture is turned around into position for tapping the 6–32 hole. For this operation, the ear *E* is placed in the slotted opening *F*. The screw *G* acts as a hold-down in this case.

Data pertaining to the kind of material tapped, size of hole, kind of tap used, speed of tap, production in pieces per hour, together with the cost of the fixture for each piece of work illustrated and described, are given in the accompanying table. Another article on this subject will appear in January MACHINERY.

* * *

The real trouble is not due to gold or silver, or any other monetary standard, but to the way the industry and trade of the world are strangled by restrictions.—*Commerce and Finance*

Arc-Welding Display for Museum of Science and Industry

An unusual arc-welding display has been prepared for the Museum of Science and Industry, the first section of which was recently opened in Chicago. Housed in a booth of stainless steel, itself fabricated by welding, an operator demonstrates the use of the electric arc and explains the process, speaking into a microphone connected with loud speakers outside the booth. Special glass permits visual inspection of the welding going on inside the booth without danger of injury to the eyes. The inset in the corner of Fig. 1 shows what the visitor sees through the glass.

To demonstrate the cutting of steel under water, a large tank has been constructed in the main hall of the Museum. Here, as may be seen in Fig. 2, a diver in deep-sea dress actually cuts a steel bar with an oxy-electric torch while submerged in the water. A microphone placed in the diver's helmet permits him to explain the cutting process to the onlookers while he is submerged in the tank.

The welding equipment used in these demonstrations consists of a "Shield-Arc" welder and accessories made by the Lincoln Electric Co., Cleveland, Ohio, and loaned to the Museum. When this huge Museum of Science and Industry is completed, it will contain eleven miles of exhibits. All of the displays are not expected to be ready until some time in 1935.

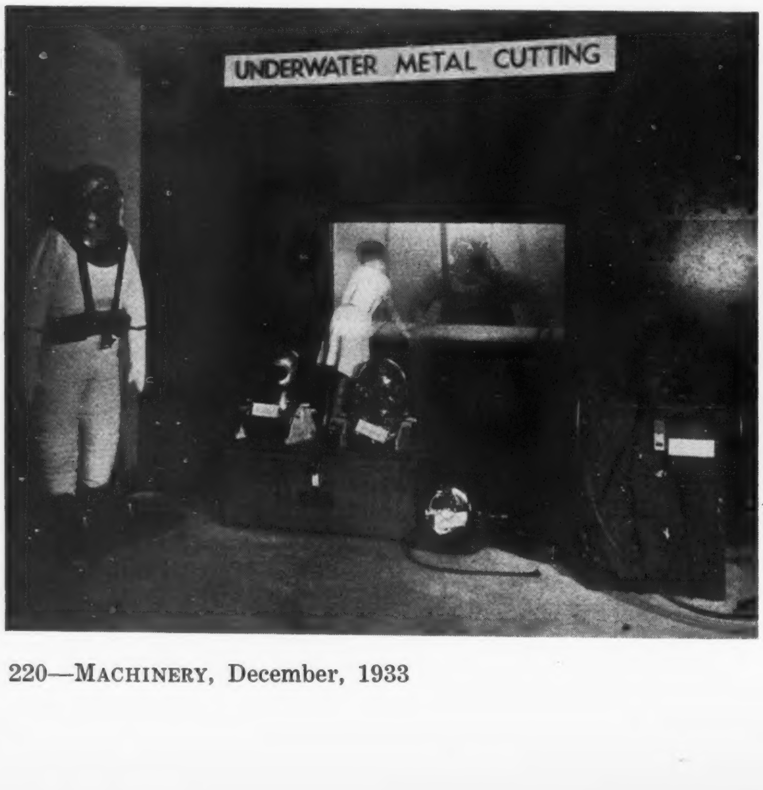
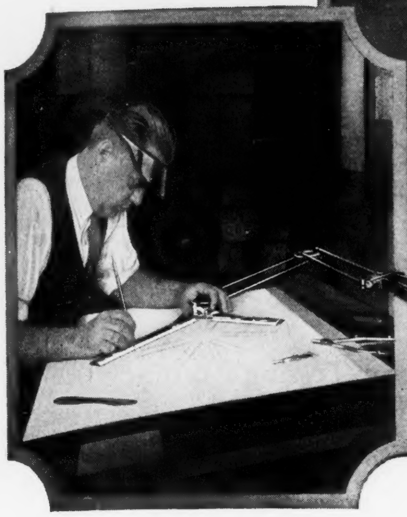
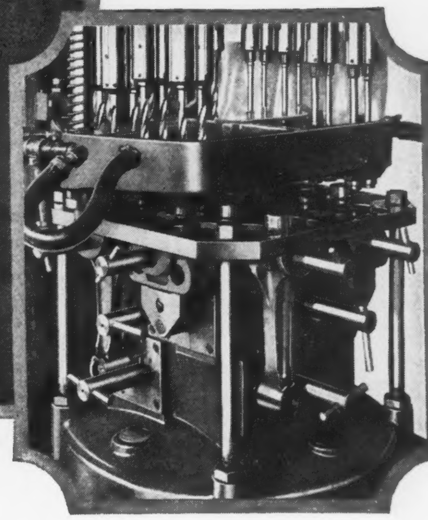


Fig. 2. Totally Submerged in Water in a Huge Steel Tank in the Museum of Science and Industry, a Diver Cuts a Steel Bar in Two with an Electric Under-water Torch



Design of Tools and Fixtures

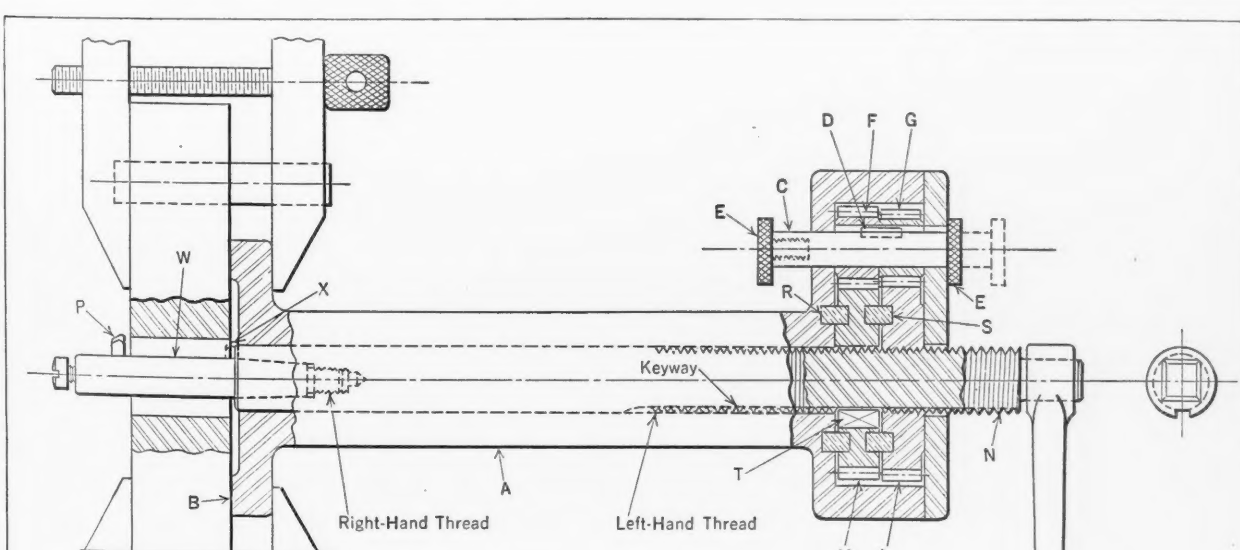


Hand Boring Tool for Shop and Tool-Room Use

By P. F. ROSSMANN, Detroit, Mich.

The boring equipment in many tool-rooms and machine shops proves inadequate during rush periods. In many cases, the set-up for boring requires more time than the actual boring operation, and very often, the completion or continuance of the work depends on some minor details that must await their turn in the boring mill. These delays result in additional expense. With the aid of a hand boring tool such as shown in the accompanying illustration, the toolmaker or machinist can perform quickly and accurately many boring operations that do not require the use of a boring mill. This permits the boring mill to be released for more difficult work.

In manufacturing departments, this tool facilitates the reboring of worn bushings or holes in fixtures that are too large to be conveniently or quickly transported to the tool-room or machine shop for repairs. The illustration shows the tool clamped in place for boring the hole *W*. The hole to be bored is previously rough-drilled or reamed, allowing just sufficient stock to clean up in the boring operation. The tool *P* is adjusted for a trial cut by measuring across the tip to the opposite side of the holder. The diameter of body *A* is machined accurately to a given size, so that it can be used as a measuring surface in positioning the tool. With



Portable Hand-operated Boring Tool with Differential Gear Feed

the feed-changing shaft C in the position shown, the crank is rotated clockwise for finish-boring. Since the thread on feed-shaft N is left-hand, the tool bit will travel inward to the position indicated at X at the rate of 0.0049 inch per revolution of the boring-bar, owing to the action of the differential gearing.

After the tool bit has reached position X, the feed-changing shaft C is shifted to the position indicated by the dotted lines at the right. This disengages the differential gearing and locks the feed-gear G. Turning the crank in a counter-clockwise direction will then return the tool bit to its initial position at a rate of feed equal to the lead of the feed thread, or 0.05 inch per revolution. The bored hole is measured for size when the tool bit is in position X.

All the important surfaces of body A are hardened and ground, and the face B is squared up accurately with the axis of the boring shaft. The differential gear-shaft C has a key D that slides in keyways in the gears F and G. Stop E at the right locates the key for locking gears F and G to the shaft for the slow feed, while the stop at the left locks only the gear G to the shaft for the rapid return movement. In the design shown, gears M and F have thirty-five and fourteen teeth, respectively, while gears L and G have thirty-six and thirteen teeth, respectively. The center hole in gear M clears the thread of the boring shaft N. The key T, which fits a slot in shaft N, serves as a drive. Gear L is, of course, threaded to fit the thread on shaft N. The spacers and bearing rings R and S fit into grooves in body A and gears L and M, as shown, so that any irregularities of the threads on shaft N will not impart an eccentric motion to gear L or allow gear M to come in contact with the threads of the feed-screw.

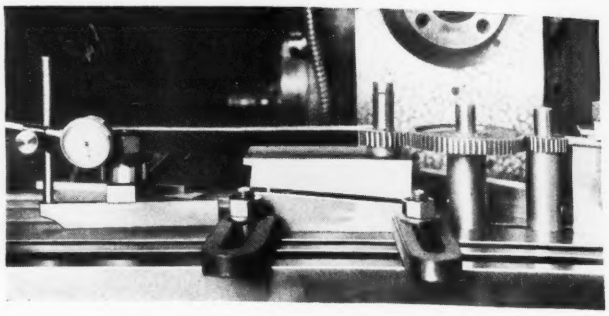


Fig. 2. Modification of Method Illustrated in Fig. 1, Used in Testing One Gear at a Time

Fixture for Testing Accuracy of Spur Gears

By O. S. MARSHALL, Pasadena, Calif.

The set-ups illustrated in Figs. 1 and 2 are used in detecting inaccuracies in spur gears, such as irregular spacing of the teeth and eccentricity of the pitch circle with respect to the axis of the bore or shaft hole. The equipment consists essentially of an indicator reading to 0.0001 inch, a gravity-actuated slide for holding one of the master gears in mesh with the gears being tested, and the necessary arbors and clamps. The sensitive gravity slide is supported on four steel balls which are held in parallel V-grooves inclined at an angle, the inclination being sufficient to insure keeping the gears in mesh under uniform tension. The upper and lower members of the slide were made from one piece which was machined to the required taper and then cut in half, midway of its length.

The indicator is positioned to make contact with the end of the gravity slide, as illustrated in Fig. 1, when two gears are being tested at the same time. The gear at the right is locked against any possible movement, while the gear on the movable slide is free to turn. It is preferable that the same tooth space be used at each position of the middle gears, which are the ones being inspected. Half the full width of the two gears being tested is in mesh with the gears to the left and right, as shown. The two latter gears have 5/8-inch faces.

The two gears being tested were cut together on a gear-cutter of the generating type. They were marked before being removed from the machine to make it possible to keep them together in the same position that they occupied while being cut and to provide a starting point for the testing operation. So long

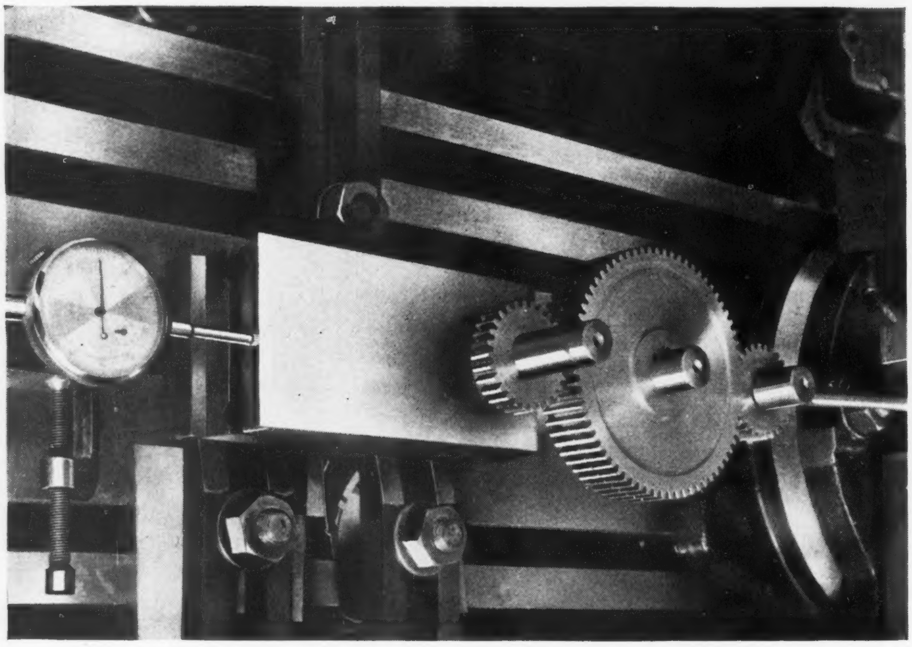


Fig. 1. Set-up for Testing Tooth Spacing and Concentricity of Two Spur Gears at One Time

as the gears are kept in the same identical tooth relationship in which they were cut, all the teeth will show perfect alignment. By lifting the upper of the two gears from its testing position without disturbing the lower gear, turning the upper gear one-half revolution and then replacing it, any error in spacing will be readily detected by the indicator. If there is an error in tooth spacing, the teeth of the gears being tested will not match in this position and consequently the gear on the movable slide will be forced to recede, the amount being registered by the indicator.

In a 100-tooth gear, for instance, the fiftieth tooth should be positioned exactly half way around the blank, but if there is any error in spacing, this tooth will be either in a plus or a minus position with respect to the half-way position. If two gears cut together have an error in spacing and either one is turned over or turned half way around, the plus error will be one side of the exact center line in the case of one gear, and on the other side of the center line in the case of the other gear.

A variation of the method described is shown in Fig. 2. Practically the same set-up is employed, but only three gears are used; that is, two besides the one being tested. The gear at the right is locked, as in the first method. The one at the left is provided with a multiplying bar, its opposite end engaging a sensitive indicator. The middle gear is the one being tested. If the middle gear is lifted from its pivot, turned any number of teeth, and replaced, any irregularity of tooth space or eccentricity in relation to its hole will cause the gear on the movable slide to rotate. This movement will be immediately registered by the indicator.

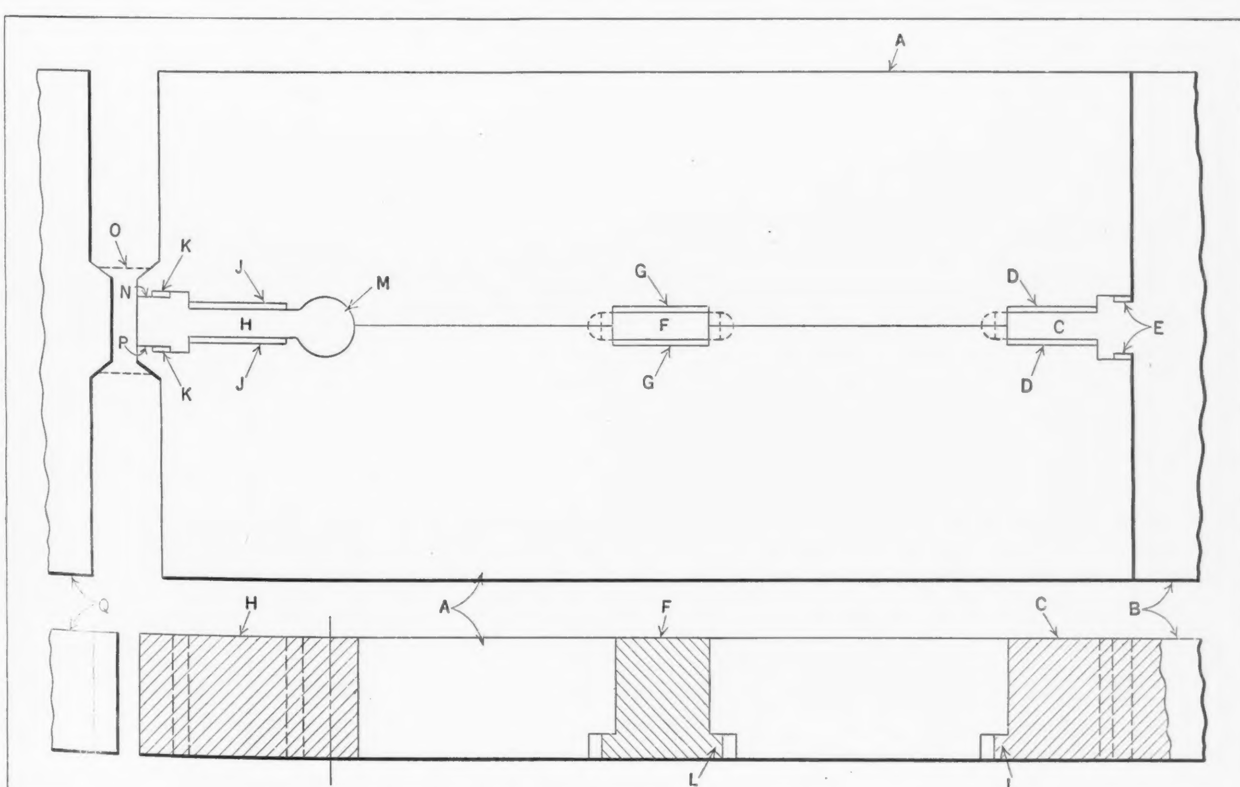
The testing equipment described was set up on a milling machine platen. The slide was controlled against side movement by ordinary clamps, and all studs on which the gears were mounted were carefully aligned.

Built-up Construction for Die with Long Narrow Piercing Slots

By EDWARD HELLER, Cleveland, Ohio

The die shown in the accompanying illustration is used for slotting and cutting off strip stock. The construction of this die presented some difficulties, as the slots *D*, *E*, *G*, *J*, and *K* are only 0.024 to 0.034 inch wide. The total length of the piece to be pierced and cut off is about 5 1/4 inches. The dimensions of the slots and length of the piece cut off are required to be held to size within 0.002 to 0.003 inch. The built-up construction used for the die is also applied in a modified form to the stripper plate. The upper view shows the plan of the die, while the lower view shows a vertical section through the side where the two halves *A* meet.

The die is made up of the two pieces *A*, the end piece *B* with its projecting piece *C*, the piece *Q*, and the insert *H* which fits in between the two pieces *A*. This assembly forms the slots *D*, *E*, *J*, and *K*. At the middle, the small insert *F* forms the open-



Die Having Long Narrow Piercing Slots Formed by Built-up Construction

ings G. The piece C and insert F are held down by the tongues L that project into recesses in the die-blocks A, while insert H is held in place by the tapered fit of the round part M and the ends N and P, which are enlarged at the base.

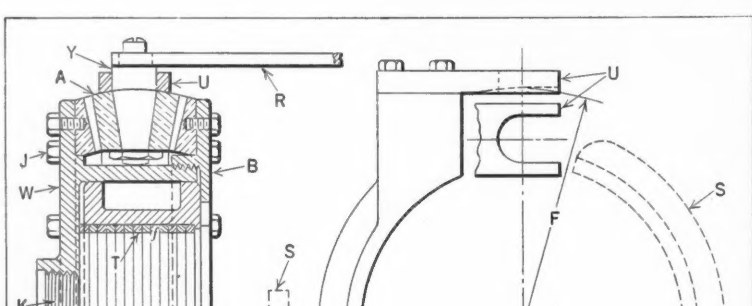
The block Q, together with the left ends of die-blocks A and insert H, forms the cutting-off portion of the die, where a slug O is punched out. The method of constructing the die here illustrated not only simplified the job, but decreased the cost of upkeep, as it was possible to replace the sections when they became worn without much expense.

Chuck for Holding Piston-Rings

By STANLEY EDWARDS, Denver, Colo.

The gear-operated chuck shown in the accompanying illustration was designed to hold twelve automobile piston-rings of special design while boring their inner surfaces at T. This chuck is of novel construction in that discarded automobile differential ring gears from a Model T Ford provide means for obtaining the clamping action. The body W and flange B are threaded together at C. These parts are of steel and are secured by screws J to the differential ring gears M. A larger chuck of similar construction has also been made, which is fitted with gears from the differential of an old-model Dodge automobile. These two types of automobile gears have the "hand" of spiral required for this purpose. The gears were annealed to permit the necessary machining work to be done, but not rehardened.

Body W was bored to receive the cast-iron rings D and threaded at K to fit the lathe spindle. The rings D were bored on the inside to suit the piston-rings to be machined, and were cast with two flanges as shown. Two rings of each size were provided, so that the operator could load one while the other was being bored. With this arrangement, one chuck body is used for several different sizes of rings. A flange was machined at the outer end of the bore of ring D which serves to grip the piston-rings against the inner face of the chuck. The innermost ring E is a dummy used to provide clearance for the boring tool.



Chuck for Holding Twelve Piston-rings while Boring their Inner Surfaces

Pinion A is provided with a stud Y which fits the bar R, used as a clamping handle. The cast-steel ring N, to which is attached the thrust plate U, is bored at O to a free running fit on the outside of body W. During the boring operation on the piston-rings, the member N is allowed to drop or revolve into the position indicated by the dotted lines at S, and is only used in releasing flange B. A spherical face is machined on the top of pinion A to fit the radius F machined on plate U.

In using the chuck, a ring D, loaded with piston-rings, is placed in the position shown. The flange nut B is then put on the threaded end of part W and spun up snugly by hand. The pinion A of the wrench made up of the pinion and handle R is now dropped between gears M at the top with ring N in the position indicated by the dotted lines S. The pinion wrench is turned clockwise as far as convenient with bar R. For a new clamping position, the wrench handle R is simply moved counter-clockwise. This causes the pinion to automatically ratchet out of mesh through the spiral action of the teeth and drop into a new position without any manipulation by hand other than that of operating bar R.

To release nut B, the pinion A is simply dropped into place with the operating handle R pointing to the left. The ring N is then raised into the position shown. The yoke U, coming in contact with the shank of pinion A, provides a means for exerting the thrust required for loosening the clamping member B. A single movement is sufficient to loosen member B, after which member N may be dropped into the position indicated by the dotted lines. The pinion can then be withdrawn and the clamping nut removed by hand, after which another loaded ring D can be quickly inserted and clamped in place. The operators of these chucks have become highly efficient in their use, with the result that production has been increased 150 per cent over that obtained with the old method of using separate bronze chucks for each size of ring machined.

* * *

Few of the books on economics that have appeared in the last twenty or thirty years show any adequate grasp of economic fundamentals. Their writers, for the most part, though bursting with "facts," seem unable to see the forest for the trees that hide it.—*Commerce and Finance*

The Mechanical Industry Speaks to the President

October 27, 1933

The President,
Executive Mansion,
Washington, D. C.

Dear Mr. President:

We take the occasion of the presentation of our Code to pledge our hearty cooperation in this effort toward industrial recovery. Our Code has been the subject of continuous thought for many weeks; we have had the effective cooperation of all N.R.A. officials to whom we have been assigned, and the resulting provisions are such as we are willing to live by.

In addition, we ask your consideration of certain elements of the present position of industry, which are not so much a part of the Act itself as of the history of its development, and of popular prejudices which have grown up about it.

Many public spokesmen, in and out of office, have warned industry that it is having its final opportunity to reorganize itself to serve social ends; and that if it does not do so it will have to be governmentally organized and controlled. There is implied in this an accusation of sole responsibility for the Nation's economic distresses which, most unfortunately, the acknowledged leaders of industry appear to have accepted. At least, no word of public protest passes their lips.

We do protest.

While admitting errors of judgment, errors even of over-reaching and greed in some instances, it seems clear to us that no correction or reorganization which could conceivably have taken place within the field of industry would have greatly mitigated the disaster of 1929 and the succeeding years; nor can we conceive of any assurance of safety for the future by such means. The major elements of disaster, as you indicated in your inaugural address, lie in the financial-speculative process; and in this respect industry is culpable only as it has permitted infection from that source. To look elsewhere is to deceive ourselves and the country at large, to arouse false hopes, and to run the risk of uncontrollable resentment should any large measure of failure appear.

This concentration of attention on industry has other unfortunate results. The primary sin is conceived to have been an unrestrained over-production of goods; and the corresponding remedy is presumed to be a scale of production planned under governmental supervision to fit such remnants of effective demand as may happen to show themselves, however paltry and miserable they may be. Many industrial leaders have fallen into this error, and have sought to build the provisions of their codes about it. It would be difficult to find a policy more destructive of our justifiable hopes and real possibilities.

Admitting the over-development of certain businesses tied in with the financial-speculative orgy (city real estate, for instance), we remain convinced that the scale of material production, consumption, and enjoyment which we experienced in 1929 is one which we may again attain, attain with safety and with safety surpass. No one who looks about him can be satisfied with any rate of production we have ever attained. At no time has the great mass of those able and willing to work been adequately housed or properly clothed and fed; nor has it had in abundance the means of rational enjoyment. The hope of industry for a prosperous future lies in filling these unfilled needs. For investors also there is here an opportunity more surely profitable than financial-speculative processes can ever hope to be.

Another deterrent to recovery is the growing fear of improved machinery and processes. Through the Codes and the President's Re-employment Agreement, we have shortened working hours enough so as to raise some doubts as to a greatly increased standard of living under the new order. A raised standard of living can only come as a result of an increased spread between wages and prices, by raising wages relatively to prices. The extent to which this can be done is limited unless we apply the tried and tested method—the direct and obvious method—that of improved processes, organization, and machinery. There is no other way.

We are faced with these three false theories: (1) The primary culpability of industry; (2) the actuality of over-production; and (3) the social danger of improved machinery. This cumulation of error has checked the natural growth of industrial courage and enterprise which would otherwise begin to appear at this time; it has throttled recovery in the capital goods industries, which are the very seat and center of the depression; and it bids fair to degrade the hopeful, humane experiment of the National Industrial Recovery Act into a mere expansion of the share-the-work movement—powerless to generate new work, or to distribute much more in payroll dollars than the sums currently available.

We need new effectiveness, new insight, new courage. Here the interests of Agriculture, Labor, and Capital, of farmer, worker, and employer, are one. It would be tragic to endeavor, by the exercise of minor tactics, to force the issue on the old lines of conflict. We believe that your incomparable leadership can properly and effectively be engaged in discrediting the errors mentioned above, in the re-generation of that justifiable courage and spirit of enterprise which are essential to a solid recovery, and in the continuing search for methods of control for the financial-speculative menace.

Here lie our common task and our common hope.

Respectfully yours,
RALPH E. FLANDERS,
Chairman, Code Committee
NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Slush Castings

W. W.—I would like to obtain information on the making of slush castings. What metals or metal alloys are used for this purpose? What materials are used for making the molds? What precautions should be taken in making the castings?

These questions are submitted to MACHINERY'S readers.

Alloy Steels for Drop-Forging Dies

F. R.—Nickel alloy steel has recently been recommended for drop-forging dies in several papers read before engineering societies. What grade or composition of nickel steel should be used for such dies?

A.—According to *Nickel Steel Topics*, the most widely used alloy steels for drop-forging die-blocks are composed of from 0.50 to 0.70 per cent carbon, from 0.40 to 0.80 per cent manganese, from 0.60 to 1.30 per cent chromium, and from 1 to 2 per cent nickel.

Nickel-chromium-molybdenum steels are also finding increasing application for drop-forging dies. A typical composition used by one of the leading die-block manufacturers is as follows: Carbon, 0.55 per cent; manganese, 0.60 per cent; nickel, 1.50 per cent; chromium, 0.70 per cent; and molybdenum, 0.20 per cent.

Cyanide Hardening

E. G. B.—The following questions pertaining to cyanide hardening are submitted to MACHINERY'S readers: (1) In hardening by the cyanide process, is it preferable to use straight cyanide of potassium or are there other materials which, when added, would improve the depth of penetration and the degree of hardness? If so, in what proportions should these materials be used? (2) What is the best method of handling small articles—say, 1/4-inch set-screws—so that when they are withdrawn from the heating liquid and thrown in the water there will be no "explosion?" (3) What is the best material for the cyanide pots? Is heat-resisting steel recommended?

**Answered by D. A. Shaw, Tool-Room Foreman
Flannery Bolt Co., Bridgeville, Pa.**

The company with which the writer is connected has operated a cyanide hardening department on quantity production work for the last fourteen years. Normally, this department operates on a twenty-four-hour basis, six days a week. Our experience covers the use of pots in electric furnaces having electrodes or heating elements immersed in the cyanide. Electric furnaces having heating elements surrounding the outside of the pot and gas furnaces are also employed.

This department was a constant worry to the management because of frequent failures of the cyanide pots and consequent loss of production. A number of different kinds of pots were tried that proved unsatisfactory for one reason or another. Pressed steel or ingot iron resisted the corrosive action of the cyanide, but deteriorated very rapidly from oxidation.

Alloy pots resisted the burning away action on their outer surfaces, but were found to develop other objectionable characteristics. The poor thermal conductivity of alloy materials is well known. This characteristic, together with the heavier walls necessary in cast pots, required the maintenance of a much higher temperature in the combustion chamber.

The pots were found to fail in service for the following reasons:

1. Oxidation of the outer surface by contact with air and other hot gaseous mixtures.

2. Corrosive action of the cyanide in contact with the inner surface.

3. Dissolving or leaching out of nickel and chromium content of the alloy when in contact with the cyanide.

4. Embrittlement and cracking due to progressive chemical and molecular changes.

5. Cracking due to repeated heating and cooling.

6. Defects such as blow-holes and spongy spots incident to the casting of heat-resisting alloys.

7. Electrolysis of alloy pot materials due to imperfect mixing or to segregation of the constituents.

8. Settlement of scale from the work and inert material in the cyanide to the bottom of the pot. These settlings prevent the conduction of heat and cause rapid burning away of the bottom of the pot.

9. Leakage of the cyanide into the combustion chamber, causing a destructive corrosive action.

10. Overheating due to poor thermal conductivity, or localized heating due to impingement of the flame on the pot.

A search for some material or combination of materials that would give longer pot life was conducted by F. K. Landgraf, general superintendent, and G. R. Greenslade of our company. After many experiments and tests, the ductile pressed-steel pot was chosen as the best cyanide container and

nickel as the best heat-resisting element for the outside of the pot when used in the electric furnace. When used in a gas furnace, it was found necessary to employ a chrome-nickel combination for the heat-resisting element on the outside of the pot, as nickel alone would not resist the action of the hot gas. Different methods of combining these materials with the pressed-steel pot were tried.

From the experience gained, the "Niclad" method of progressively depositing the nickel or chrome-nickel alloy by electric welding was developed. Pots made by this process gave such satisfactory life that the process and methods were patented under the trade name of "Niclad." Pots of this material, when properly installed so as to be protected from overheating and leakage of cyanide to the outside of the pot and combustion chamber, will outlast any other kind of pot. We have records showing that these pots are giving 3000 to 7000 hours of service, whereas alloy pots under the same conditions failed in 300 to 1000 hours.

The heat-resisting element on the outside of "Niclad" pots is comparatively thin, and thus offers slight resistance to heat conductivity. Pots of this material have resulted in a saving of time, labor, and materials.

The process of cyanide hardening or surface hardening can be accomplished with potassium cyanide or with sodium cyanide. Detailed investigations have shown that some of the hardness resulting from cyanide treatment is due to nitrogen absorption and some to carbon absorption. The greater the carbon content of the case produced on the work treated, the less the nitrogen content of the work. As temperatures are increased, the percentage of carbon in the case increases and the amount of nitrogen decreases.

The length of time the work is immersed in molten cyanide is an important factor. In general, it has been found that after twenty minutes, penetration proceeds very slowly and any additional time gives little increase in the penetration. Sodium cyanide, due to its efficiency and lower cost, is largely used in place of the more expensive potassium cyanide. Molten sodium cyanide is quite rapidly decomposed when heated above 1580 degrees F.

Sodium cyanide is obtainable in four different grades—namely, 96 to 98 per cent, 75 per cent, 45 per cent, and 30 per cent. Experience has proved that for our particular work, the 45 per cent sodium cyanide gives the required results most economically. The additions to the 45 per cent sodium cyanide are sodium carbonate, 37 per cent, and sodium chloride, 18 per cent. The addition of these tends to retard the decomposition of the sodium cyanide without being detrimental to its casehardening properties. There appears to be no known material which can be added that will improve the depth of penetration and degree of hardness.

When this mixture is used in production work, its cyanide strength can be maintained through the addition of small amounts of 96 to 98 per cent or 75 per cent sodium cyanide, or the weakened cyanide can be used in preheating pots and the 45 per cent material for the final treatment. The 30 per cent sodium cyanide is frequently used in production jobs. Owing to its high percentage of inert material, the decomposition of the sodium cyanide is greatly retarded. Solutions under 30 per cent have proved impracticable.

Automotive Helical-Gear Transmissions

F. R.—In ordinary helical-gear transmissions it is customary to use fairly small helix angles. Often an angle as small as 7 degrees is used; 12 degrees is favored by some designers; and 23 degrees is customarily used for double-helical or herringbone gears. In automotive practice, however, these angles have been greatly increased, 45 degrees and even larger angles being used.

Now this question arises: Were these angles increased simply with a view to obtaining quieter gearing? Presumably, the steeper angles do not produce gears with as high efficiency. Was some of the efficiency sacrificed in order to obtain greater quietness? What is, at the present time, the most commonly used angle for these gears?

Answered by Fred W. Cederleaf
Olds Motor Works, Lansing, Mich.

The angles of the helical gears used in automotive transmissions were increased in order to obtain quieter gearing. However, later tests have shown that it is not necessary to use as steep helix angles as were first employed to obtain the best results. In theory, the steeper the angle, the quieter should be the gears, because of the tooth overlap; but this is true only of perfect gears, and perfect gears are not produced in regular production work.

Steeper angles no doubt reduce the efficiency due to increased end thrust; but as the temperature of the transmission in operation never rises to any troublesome degree, this factor evidently is not a serious problem. Generally speaking, the helix angles of transmission second-speed gears in use at the present time range from 25 to 45 degrees, and the tendency is to use smaller angles.

Some years ago, tests were made to determine, if possible, just what angle should be used to obtain the greatest degree of quietness for the second-speed gears in a transmission. Sets of gears, beginning with spur gears and ending with 45-degree helical gears, were cut and lapped as nearly perfect as possible. All the gears were cut with the same hob and finished with the same lap, after which they were thoroughly inspected. The pinion and drive gear were in a 2 to 1 ratio, the helix varied by 5-degree increments from spur gear (0 degree) to 45 degrees. An adjustable-center-distance case was used. The general results of the tests were that the noise decreased until a 20-degree angle was reached, but from that point on, there was no noticeable improvement.

Notes and Comment on Engineering Topics

Failure to provide proper lubrication seems to be a common evil among many users of small mechanical devices. This deficiency is probably due to the erroneous impression that devices functioning under light loads do not require much attention. To appreciate the unsoundness of such reasoning, one need but turn to the large users of telephone and telegraph equipment and note the care they give their small machines for the sending of fire alarms, the transmission of sound, and the dissemination of news.—*Technical Bulletin of the Acheson Oildag Co.*

Stainless steel conveyor bands are now being cold-rolled in lengths up to 400 feet and less than 0.004 inch in thickness by the Sandvik Steel Works in Sweden. The greatest width to which strip of this kind is rolled is 2 feet 7 inches, but wider conveyor bands can be produced by joining two strips longitudinally. These stainless steel conveyors, being immune to rust, are proving of great value for transportation in industries where cleanliness is essential and in plants where the air contains steam or acid gases.

According to the National Automobile Chamber of Commerce, the automobile industry consumes 80 per cent of the rubber, 43 per cent of the glass, 53 per cent of the leather upholstery, 33 per cent of the lead, and 28 per cent of the nickel produced in the United States.

Photo-electric equipment for indicating and recording the degree of density of smoke passing through the stacks of power and heating plants has been announced by the General Electric Co. The changes in smoke density are indicated by a meter. A running record of the amount of smoke passing up the stack may be obtained by the addition of a recording instrument.

The essential elements of the apparatus are simply a light source and a photo-electric relay unit, the recording instrument being added if desired. The photo-electric unit and the light source are mounted on opposite sides of the stack so that the light beam passes through the stack and falls on the phototube; hence, when there is no smoke in the stack, the full intensity of the light is directed on the phototube and the indicating instrument registers zero. As the smoke density increases, the phototube receives less light from the source and the instrument indicates the increase of smoke.

It seems a little strange to think of wheelbarrows provided with rubber tires; nevertheless, such tires are now being manufactured by the B. F. Goodrich Rubber Co., Akron, Ohio. The new tires are of the low-pressure type and are particularly advantageous when wheelbarrows are used in mud or deep sand, where the old type of wheel would sink so deeply into the ground that it would be practically impossible to move the wheelbarrow. The low-pressure rubber tires considerably reduce the effort required to push a wheelbarrow even on level ground, according to tests made. When breakable objects are moved by wheelbarrows, breakage is greatly reduced by the use of the rubber-tired equipment.

According to G. H. Froebel, manager of the oil-electric and marine industries of the Westinghouse Electric & Mfg. Co., oil-electric locomotives will not only effect immediate operating economies, but will actually pay for themselves out of savings in as short a time as eighteen months. This statement is based on an actual record of these locomotives in service covering 5,000,000 car-miles and 100,000 locomotive hours. According to Mr. Froebel, Diesel electric equipment is the most efficient and economical of any yet devised in the field of transportation.

A silvered-glass reflecting mirror 87 1/2 inches in diameter, which is believed to be the largest in the world, was recently made by C. A. Parsons & Co., Ltd., at the Heaton Works, England, where parabolic and elliptical mirrors for searchlights and other purposes are produced in quantities. The procedure followed by this plant in the manufacture of large reflecting mirrors is described briefly in *Engineering:*

The best selected plate glass obtainable is employed for reflecting mirrors, care being taken to have the glass as free from flaws, bubbles, striæ, color, and other defects as is commercially possible. After the glass is shaped to the required form, it

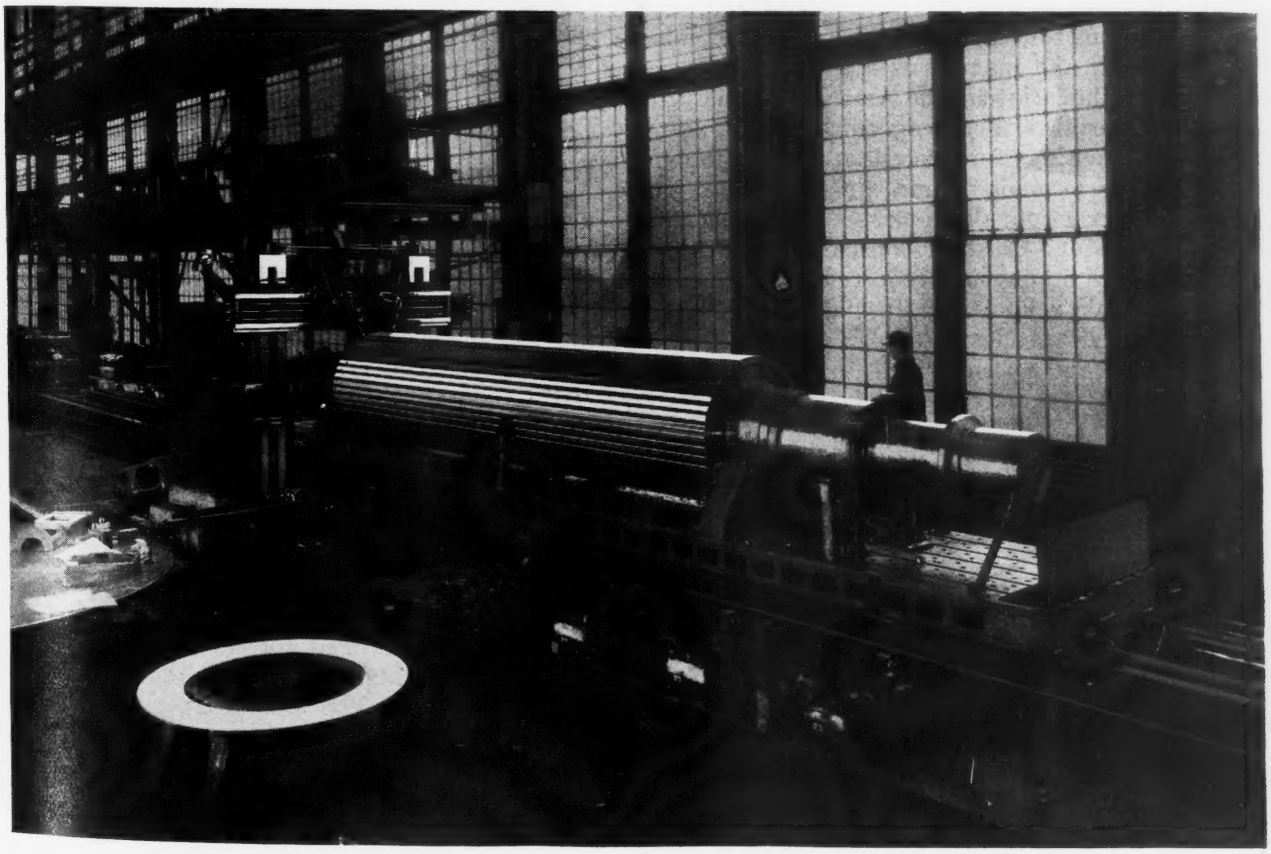
is optically ground and polished on the two surfaces. A heavy coating of chemically pure silver is deposited on the convex surface. This coating is then protected by an electrolytic deposit of copper, which, in turn, is protected either by a backing of special heat-resisting paint or by a patented lead-and-wire backing. The latter backing consists of a covering of sheet lead over which phosphor-bronze wire netting is stretched, the whole assembly being retained in position by a copper band of channel section which is clamped around the outer edge.

The earth's surface has been penetrated to a depth never before attained in the Kettleman Hills oil field in Southern California. Here the drilling of a well was started April 12, 1932. On April 22, 1933, the previous world's record depth of 10,585 feet was passed. A depth of over 11,000 feet has since been reached, the drilling being continued in an effort to reach stratas productive of oil.

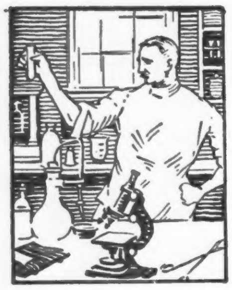
The estimated total production of automobiles and trucks within the Soviet Union in 1932 included 6500 automobiles, and 39,000 trucks and buses; 5000 of these trucks were assembled from Ford parts, and 1500 Ford-type automobiles were made with one-half of the parts imported. The remainder of the trucks and automobiles were made at Soviet plants. There are, at present, three automobile factories and one assembling plant in the Soviet Union. Bicycles are also coming into very general use there. Several plants are manufacturing them.

From time to time the railroads are called upon to perform exceptional transportation services. The *Railway Age*, in commenting on some of the unusual transportation problems that have to be met by the railroads, mentions how at one time an eastern railroad was called upon to transport eighteen seaplanes on thirty-six cars from the Curtiss Plant in Buffalo, N. Y., to New York City for export. The height of the crates containing the planes exceeded the clearance on all the eastern railroads except one, and on this one they failed to clear one highway bridge by three inches. To overcome this obstacle, the tracks were lowered that amount and then restored after the train had passed.

A 72- by 72-inch by 40-foot Gray Planer in the West Allis Works of the Allis-Chalmers Co. Slotting the Rotor of an 80,000-K.W. Turbo-generator. This Planer is Capable of Handling Work Weighing up to 200 Tons, at Cutting Speeds up to 85 Feet per Minute, and Return Speeds up to 180 Feet per Minute. Automatic Clamping Devices and Oiling System are Provided. A 100-H.P. Allis-Chalmers Ultra-speed Drive Permits Shockless Reversal and Automatic Speed-up for Intermittent Cuts



MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Large and Small Gears Made of a Laminated Phenolic Material

Gears as small as 1/4 inch pitch diameter for transmitting 0.06 horsepower per inch of face at a speed of 100 feet per minute, and gears as large as 60 inches pitch diameter for transmitting 58 horsepower per inch of face at a speed of 3000 feet per minute, are being made of Spauldite. This material is manufactured from tightly woven fabric, thoroughly impregnated with a phenolic binder. The saturated fabric sheets are forced under heavy pressure and intense heat into a dense homogeneous mass. Spauldite is a product of the Spaulding Fibre Co., Inc., Tonawanda, N. Y.

New Specifications Issued for Carbon-Steel Castings

Specifications for carbon-steel castings for industrial, railroad, and marine uses were recently approved for publication by the American Society for Testing Materials. These specifications apply to carbon-steel castings for miscellaneous and jobbing purposes, for locomotive and air equipment, and for ship construction. Two classes and five grades are provided for: Class A consists of one grade only, for which no physical requirements are specified. This grade is known as Special No. 1. Class B consists of four grades: Regular, Special No. 2, Special No. 3, and Special No. 4, for which the following physical requirements are specified:

	Regular	Special No. 2	Special No. 3	Special No. 4
Tensile strength, pounds per square inch	70,000	60,000	60,000	80,000
Yield point, pounds per square inch	38,000	30,000	30,000	43,000
Elongation in 2 inches, per cent	24	22	26	17
Reduction of area, per cent	36	30	38	25

The maximum carbon content of Class A castings is 0.45 per cent, with manganese 0.50 to 1 per cent; silicon, 0.20 to 0.75 per cent; phosphorus, maximum, 0.05 per cent; sulphur, maximum, 0.06 per cent.

No carbon content is specified for Class B castings, inasmuch as the physical requirements are given. The other elements in the Class B castings are the same as in Class A castings.

The regular grade of Class B castings is the material required for most miscellaneous structural purposes, for large tonnages of castings for railway rolling stock, and for many ship castings. This grade is readily machined. The special grades Nos. 2 and 3 are used mainly for large castings for railway equipment. These grades are intended to have low carbon content, making the material easily machineable either in the "as cast" or in the annealed condition. Grade No. 4 is used for purposes calling for higher strength and less ductility than are available in the other grades. It is usually machineable without appreciable difficulty on modern machine tools—that is, on machines that have sufficient rigidity and power.

Tool-Steel Welding Rod for Worn Tools and Machine Parts

When it is not practical to use pieces of tool steel for the wearing surfaces of tools or machine parts, such surfaces can be built up of Krokoloy tool-steel welding rod. This rod is made for both electric and oxy-acetylene welding by the Detroit Alloy Steel Co., Detroit, Mich. It is carried in stock in 3/16- and 1/4-inch diameters and in standard lengths.

Die-Castings Stronger than Regular Structural Steel

An average tensile strength of 85,000 pounds per square inch is claimed for aluminum-bronze die-castings now being produced by the Aurora Metal Co., Aurora, Ill. The tensile strength can be increased by heat-treatment to 100,000 pounds per square inch. The hardness of the metal as cast is about 140 Brinell, and it can be increased to 260 Brinell by heat-treatment.

The composition of the metal used for these die-castings is 89 per cent copper, 10 per cent aluminum, and 1 per cent iron. The castings are especially adaptable for applications where high strength, resistance to corrosion, and absence of ageing are important factors. Typical aluminum-bronze die-castings made in the past have included parts for outboard motors, manifolds, paint spraying machines, gasoline measuring devices, and similar equipment.

A Rustproofing Liquid that Gives a Finish Coat in Colors

New or rusted metal surfaces can be brushed or sprayed with "Rustproofer" to prevent or arrest rusting. This is a liquid product of the Stonhard Co., 401 N. Broad St., Philadelphia, Pa. When applied to a rusted surface, the liquid joins the rust to the base metal and forms a non-porous, moisture-proof, air-tight coating that renders the surface immune to further attack of rust.

Aluminum powder, powdered graphite, or dry red lead can be mixed with "Rustproofer" to obtain various color effects in a single application. When the liquid alone is applied, a transparent coating is obtained through which markings or identification signs remain visible.

Steel Strip Annealed in Gas for the Electrical Industry

Seven grades of silicon steel strip are now being made at the Warren, Ohio, Works of the Republic Steel Corporation for use in the manufacture of transformers, dynamos, motors, and armatures. The material is made in widths up to 31 1/2 inches, and in various thicknesses from 0.0125 to 0.031 inch. The silicon content ranges from 4.5 per cent in an extra special transformer grade, down to 0.5 per cent in an armature grade.

An outstanding feature of the manufacturing process is an annealing operation that is carried out in a continuous electric furnace. This furnace has five heating zones, each of which is automatically controlled. There is a slight increase in the temperature of each succeeding zone, the difference between the temperatures of the first and last zones being about 200 degrees. The annealing temperatures range from 1500 to 1900 degrees F.

Natural gas is burned in this furnace to provide a protective atmosphere against oxidation. The natural gas is burned under controlled conditions to yield an atmosphere with a normal content of approximately 6 per cent each of hydrogen, carbon monoxide, and carbon dioxide. The balance is nitrogen. About 1000 cubic feet of gas is required per hour. This is obtained from 150 cubic feet of natural gas.

Dies Cast to Shape from an Oil-Hardening Steel

A new cast-to-shape oil-hardening die steel has been developed by the Kinite Corporation, Milwaukee, Wis., and Fairmount, W. Va. This steel, which is known as K.O.H., is particularly adapted for making cast-to-shape dies for short production runs, where the first cost of the die is an important factor and where exceptional resistance to wear is essential.

Little machining is required on these cast-to-shape dies, and hence they can be produced quickly. This new steel is a companion product to Kinite, another cast-to-shape steel alloy which is particularly suitable for tools and dies that are to be used in unlimited production schedules.

Beauty and Cleanliness Characterize this Kitchen, which is Equipped throughout with the Allegheny Steel Co.'s 18-8 Chrome-Nickel Steel

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

I was much impressed by the article "Industrial Management Based on Common Sense," on page 143 of November MACHINERY, and the editorial "Labor's Obligation in the Industrial Recovery Program," on page 146. These two articles emphasize the importance of cooperation between management and employes. One of them shows how the management can promote this cooperation, and the other what employes can do in their own interests to further the return of prosperity, employment, better wages, and improved living conditions.

It would be of value to managers throughout industry to learn how other managers have been able to promote friendly and cooperative conditions in their plants. Any case of success in this direction ought to be recorded in MACHINERY, together with the means whereby such friendly cooperation has been achieved. Those plant managers who feel that they have succeeded along these lines would do a great service to their industry if they would give others the benefit of their experience.

HERBERT OLIVER

Operating Under a Code

The writer would consider it of value if MACHINERY could place on record some information regarding the results obtained in industry by operating under one of the newly adopted codes. The National Industrial Conference Board has published some figures pertaining to one manufacturing industry. Data were obtained from all the plants in this industry for the first full week in June and the last full week in August. The temporary code became effective in July. According to the figures given, the changes taking place from early in June until the end of August were as follows:

Number of people employed increased 10.3 per cent.

Total payrolls increased 14.3 per cent.

Average hourly earnings increased 27.4 per cent.

Average weekly earnings increased 3.6 per cent.

Total man-hours per week declined 10.4 per cent.

Average weekly hours per employe declined 18.9 per cent.

Volume of weekly production declined 9.9 per cent.

Production per man-hour increased 0.6 per cent.

Payroll cost per unit of output increased 26.8 per cent.

Wage rates of 25 per cent of the wage earners and salary rates of 4 per cent of the salaried workers were increased to comply with the established minimum rate.

General increases in wage rates other than in compliance with minimum requirements were granted by 54 per cent of the plants in the industry.

OBSERVER

[Plant managers and superintendents are invited to express their views as to the effect of codes put into operation in their plants. Percentage figures indicating the effect of the application of the code would be of interest and value to other manufacturers. The effect on industry of the new codes is of paramount importance and an open discussion of this subject in MACHINERY should be of value to everyone engaged in industry.—EDITOR]

Automatic Recorder of Time that Salesmen Have to Wait

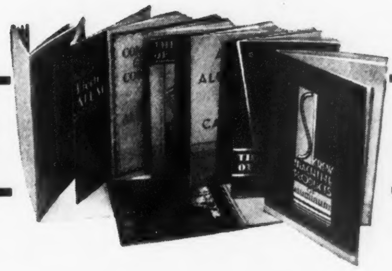
We have recording instruments for almost everything that concerns efficiency in industrial work. As yet, however, no one has thought of a recorder of time involuntarily wasted by salesmen waiting in the outer lobby of manufacturing plants.

There are times when it is necessary to ask a man to wait a reasonable length of time, but how interesting it would be to have a permanent record of the total time that salesmen are asked to wait. An instrument for this purpose, it seems, could be quite simply constructed. Each visitor, upon arriving, would be asked to push a button. The attendant at the information desk could again push a button at the time that the waiting salesman was ushered into the inner office; in this way the waiting time would be recorded.

The record would be of interest to the general manager in checking up on how long visitors and salesmen are kept waiting. Every manager is interested in this because, just as in his organization salesmen are kept waiting, so his own salesmen are being kept waiting in other plants. A recorder of this kind might have a salutary effect. I hope that MACHINERY will prominently mention the name of the first firm that installs one.

SALESMAN

[While no recorders such as suggested have been installed, MACHINERY has, from time to time, mentioned firms that make efforts to prevent waste of salesmen's time.—EDITOR]

NEW TRADE  LITERATURE

Any of these Publications can be Obtained by Writing to the Manufacturer or to MACHINERY. Send for Your Copy Today.

DIE-HEADS. Landis Machine Co., Inc., Waynesboro, Pa. Bulletin F-80, illustrating, describing, and giving complete specifications of a new series of Landis hardened and ground die-heads intended for high-production or heavy-duty service or where the threads must be held to extremely close limits. This series includes Lanco Type V revolving die-heads for hand-operated, semi-automatic, or automatic threading machines; Landex Type L revolving die-heads for automatic screw machines—also applicable to other types of machines employing a "live" spindle and on which the die-head clearance is limited; and the Landmatic Type H stationary, self-opening die-heads for turret lathes, hand screw machines, or automatic screw machines employing a stationary-type head.

ALUMINUM. Aluminum Co. of America, Pittsburgh, Pa. Pamphlet containing detailed information on the welding of aluminum and its alloys. The information given covers both fusion and resistance welding, and includes directions for flame adjustment, preparation for welding, preheating, supporting the work, torch manipulation, equipment and much other information of value to anyone engaged in welding material of this class. Pamphlet containing complete information on the riveting of aluminum and its alloys. The subjects covered include the strength of riveted joints, design proportions of riveted joints, and driving procedure for riveted joints; selection of rivet alloy; and aircraft riveting.

STAINLESS STEELS. Carpenter Steel Co., Reading, Pa. Bulletin containing working data and technical information on Carpenter stainless steels. The data are arranged in convenient tabular form. The information given enables the user to select the proper grade of stainless steel for his particular purpose. The data include analyses, properties, and characteristics of the different grades. Working instructions are included, such as forging, annealing, heat-treating, pack-hardening, welding, brazing, and soldering. Information is also given on machining stainless steel, as well as data on stainless steel stampings—grade to use, working instructions, etc.

METAL-SPRAYING EQUIPMENT. Metals Coating Co. of America, 495 N. Third St., Philadelphia, Pa. Bulletin 1201, treating of the subject of metal coating by means of the MetaLayeR process. The bulletin contains information on the properties of metal coatings, adhesion, preheating and post-heating, detachable metal coatings, joining metallic and non-metallic materials, fire-resistant coatings of inflammable materials, appearance, comparison of metal coatings with other types, sand or grit blasting, the finishing of metal coatings, etc. Bulletin 1202, containing illustrations of metal spraying and sand blast installations and metal-spraying equipment.

THYRATRON CONTROL FOR ELECTRIC WELDING. General Electric Co., 10 Canal St., Schenectady, N. Y. Bulletin GEA-1679, describing a development of importance to those engaged in welding—namely the application of the Thyratron power tube for automatically controlling the welding circuit of spot and line welding machines. The advantages of this method of control are pointed out, and the results obtained on various classes of materials are described. The bulletin gives all essential details concerning the equipment and its operation.

THRUST AND JOURNAL BEARINGS. Kingsbury Machine Works, Inc., 4322 Tackawanna St., Philadelphia, Pa. Bulletin G-1, containing 60 pages of data of especial interest to designers of marine and heavy industrial machinery on applications of new standard thrust bearing and journal bearing mountings for horizontal shafts ranging from 2 3/4 to 23 1/4 inches in diameter. These bearings are described in detail, and tables of thrust capacities and dimensions are included.

MILLING CUTTERS. Goddard & Goddard Co., Inc., Detroit, Mich. Catalogue D, covering the complete line of "Go and Go" milling cutters, which includes high-speed steel milling cutters; inserted-tooth, shell, straddle, and facing cutters; railroad type cutters for heavy-duty slabbing, channeling, etc.; expansion reamers and hollow mills; thread hobs and hacksaw cutters. One section of the book deals with special profile and formed tools. The final section contains information on milling practice and the maintenance of cutters.

OPTICAL GEAR TESTER. Societe Genevoise d'Instruments de Physique, Geneva, Switzerland (American distributor, R. Y. Ferner Co., Investment Bldg., Washington, D. C.). Catalogue 563, describing apparatus for the rapid testing of spur and helical gears between 0.16 and 4 inches in diameter, of 50 to 10 diametral pitch. Readings of pitch and eccentricity to 0.0001 inch are made from the projection of a rectangular shadow on a glass screen.

ROUTING AND SHAPING MACHINES. Stanley Electric Tool Co., Inc., New Britain, Conn. Instruction book No. 33 for the Stanley router and shaper, a moderately priced electric machine designed for woodworking. The instruction book gives information on the care and use of the hand routers, bench routers, bench shapers, and combination unit comprising this line. It is furnished with the machines, but can be purchased separately for 25 cents.

STEEL. Jones & Laughlin Steel Corporation, Pittsburgh, Pa. Bulletin on J & L improved Bessemer screw steel. The booklet describes how the machineability of this class of steel has been improved, without sacrific-

ing other desirable qualities. Bulletin on Jalcase hot-rolled and cold-finished steel. The physical properties of the three different grades are described and the various carburizing treatments are outlined. A list of typical uses is included.

INDICATING AND RECORDING INSTRUMENTS. Brown Instrument Co., Philadelphia, Pa. Catalogue 6702, featuring the new line of Brown thermometers and pressure gages, which are available in indicating, recording, and controlling types, and have many new and improved features, including a universal case, electric chart drive, automatic pen release, combination door handle and lock, and toggle switch for chart drive.

JIG BORING MACHINES. Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio. Catalogue illustrating and describing Hauser jig boring machines for locating, drilling, boring, measuring, and checking. A list of the standard equipment and special accessories supplied with the different styles is given, as well as complete dimensions for the various sizes. A description of the tools and attachments is included.

ELECTRIC FURNACES. Detroit Electric Furnace Co., Detroit, Mich. Catalogue entitled "Electric Melting with the Detroit Rocking Electric Furnace." The book discusses the modern trend of foundry practice, the advantages of the type of furnace described, operating procedure, and applications in the production of both non-ferrous and ferrous metals. Actual operating cost data are included.

OPTICAL INSTRUMENTS. Bausch & Lomb Optical Co., Rochester, N. Y. Catalogue illustrating and describing optical instruments for use in the metal-working industries, including contour measuring projectors, toolmakers' microscopes, drill gages, optical protractors, optical indexing devices, comparators, levels, flats, thickness gages, magnifiers, etc. Specifications and prices are included.

ELECTRIC EQUIPMENT. Crocker-Wheeler Electric Mfg. Co., Ampere, N. J. Bulletin illustrating and describing the Crocker-Wheeler line of electric equipment, including alternating- and direct-current motors, generators, motor-generator sets, and speed changers. Information is also given on the flexible couplings and torquemeters made by this concern.

SMALL TOOLS. Bonney Forge & Tool Works, Allentown, Pa. Catalogue 34, describing and illustrating the complete line of Bonney wrenches, as well as the lines of screwdrivers, chisels and punches, hammers, and similar tools made by the concern. Prices of the various tools are included. Much data of use to jobbers' salesmen and mechanics are given.

ZINC PRODUCTS. New Jersey Zinc Co., 160 Front St., New York City. Pamphlet entitled "Planning, Making, Selling—Design for Profit," pointing out the part that the metal zinc plays in the production of a successful article. The booklet is illustrated with views showing the wide variety of products that can be successfully made from this material.

REFRIGERATION COMPRESSORS. Worthington Pump & Machinery Corporation, Harrison, N. J. Bulletin L-600-B2, illustrating installations of Worthington vertical duplex type refrigeration compressors equipped with feather valves. Bulletins giving specifications for the 5- by 5-inch and the 6- by 6-inch size compressors, respectively.

TRUCK AND CASTER WHEELS. Metzgar Co., Inc., Grand Rapids, Mich. Leaflet entitled "Cashing in on Hidden Profits," listing fourteen advantages of Metzgar truck and caster wheels. Data are given for the three different types of wheels, namely, regular-duty wheels, heavy-duty wheels, and super-strength wheels.

MOTOR DRIVES FOR MACHINE TOOLS. Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. Circular illustrating honing, milling, drilling, reaming, tapping, threading, grinding, and other machine tools, from the smallest to the largest sizes—all operated by Wagner totally enclosed fan-cooled Type CP motors.

SYNTHETIC PLASTIC MATERIALS. General Plastics, Inc., North Tonawanda, N. Y. Booklet entitled "Durez Primer," illustrating and explaining the seven different applications of this phenolic-resin material. The applications shown include molding compounds, varnishes, resin-impregnated paper, and resins for casting cores.

INDICATING PYROMETERS. Mishawaka Industrial Instrument Mfg. Laboratory, 936 Washington Ave., Mishawaka, Ind. Leaflets containing data on the indicating thermoelectric type pyrometers made by this company, which are available for panel mounting, wall mounting, portable use, and multiple point installations.

FLEXIBLE SHAFT MACHINES. N. A. Strand & Co., 5001 N. Lincoln St., Chicago, Ill. Catalogue containing 64 pages of information on this company's new ball-bearing line of flexible shaft machines. The various types and sizes are illustrated, as well as several attachments of value to the manufacturing industries.

TAPPING ATTACHMENTS. Charles L. Jarvis Co., Gildersleeve, Conn., has started a new monthly publication known as "The Jarvis Biax," which is intended to acquaint the reader with the products and policies of the company and also to provide some entertaining reading.

CHROMIUM STEELS. Republic Steel Corporation, Central Alloy Division, Massillon, Ohio. Booklet 220-B, containing data on Enduro 4 to 6 per cent chromium steels. The book gives the physical properties and analysis of this material, and describes the various methods of working.

SCREWS, BOLTS, AND NUTS. Pheoll Mfg. Co., 5700 Roosevelt Road, Chicago, Ill. Catalogue 34, containing tabulated data, including dimensions and prices, of the complete line of screws, bolts, and nuts made by this concern. A section of reference tables is included.

HEAT-TREATING EQUIPMENT. Hevi Duty Electric Co., Milwaukee, Wis. Leaflet descriptive of the Hevi Duty excess temperature cut-out, designed to protect all types of heating equipment against heating beyond a safe temperature for the charge.

SYNTHANE LAMINATED BAKELITE. Synthane Corporation, Oaks, Pa. Bulletin giving the properties of Synthane Laminated Bakelite—a silent stabilized gear material—and machining instructions in chart form for ready reference.

MACHINE TOOLS. Eastern Machinery Co., 3267 Spring Grove Ave., Cincinnati, Ohio. Machinery list No. 34, containing a complete list, including prices, of the rebuilt machine tools carried in stock by this company.

PRESSURE GAGES. Brown Instrument Co., Philadelphia, Pa. Circular briefly describing the outstanding features and advantages of the new Brown recording thermometers and pressure gages.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Norton Co. Introduces Six Recent Developments

An exhibit of modern grinding equipment, to be held by the Norton Co. at Worcester, Mass., during the week of December 4, will include six new developments as follows: A motorized tool and cutter grinder; a small hydraulic surface grinder with an automatic cross-feed; a line of cylindrical grinders known as the Type C; a "Nortonizer" automatic electric sizing device; a D-85 crankpin grinder; and a "Cam-O-Matic" camshaft grinding machine.

In addition, the exhibit will include a large roll grinder, a car-wheel grinder, a 10-inch Type D cylindrical grinder, and a lapping machine.

Motorized Tool and Cutter Grinder

On the motorized tool and cutter grinder, which is shown in Fig. 1, the wheel-drive motor is mounted directly on the wheel-head and drives the spindle through V-belts. The spindle is of the cartridge type and may be provided with plain bronze, ball, or double-taper bearings. The wheel-head is graduated horizontally for swiveling 360 degrees.

In the design of this machine special attention has been given to convenience of operation. The base is of such size that the operator can straddle it. A duplex arrangement permits operation of the machine from either the front or back, since the various handwheels and levers can be transferred to corresponding positions on opposite sides or from front to back. Additional levers and handwheels can be obtained for permanent installation on both sides and at the front and back.

The machine is equipped with a universal work-head that will swivel around a complete circle horizontally and 200 degrees vertically. Graduations facilitate

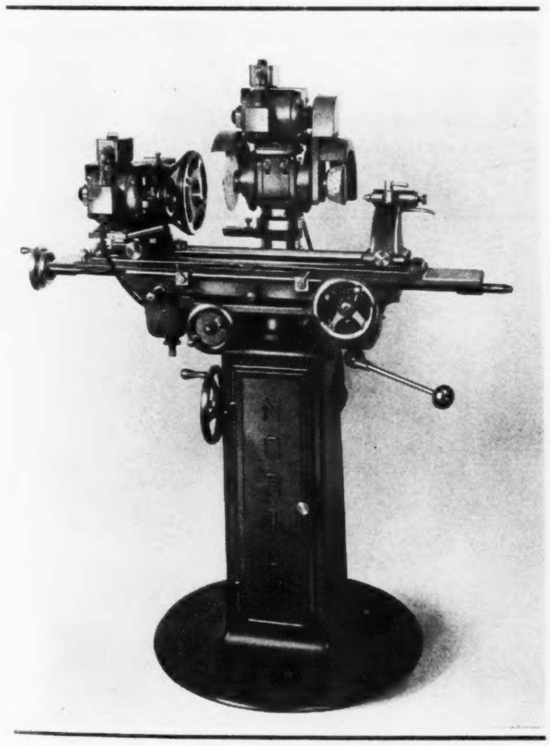


Fig. 1. Norton Tool and Cutter Grinder Designed for Operation from Either the Front or Back

Fig. 2. Small Hydraulically Operated Surface Grinder that is Provided with an Automatic Cross-feed

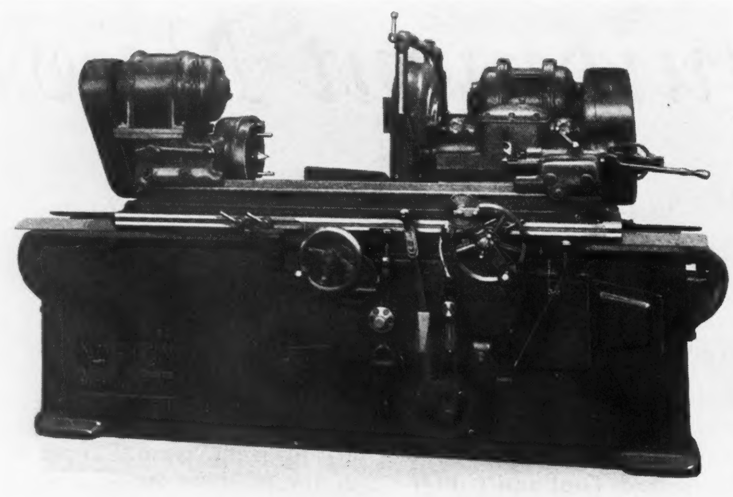


Fig. 3. One of a Line of Type C Cylindrical Grinding Machines that is Built in a Wide Variety of Models by the Norton Co.

these settings, and there is a separate set of graduations for use in setting clearance angles. Either a three-jaw chuck or a face chuck can be mounted on the work-head, and a driving motor can be attached in a few minutes. A left-hand footstock can be supplied instead of the universal work-head. Attachments for internal and surface grinding are also available.

Hydraulic Surface Grinder for Tool and Die Shops and Light Production Jobs

A 6- by 18-inch hydraulically operated surface grinder with an automatic cross-feed is shown in Fig. 2. This machine was developed primarily for tool and die shops and for light production jobs. The machine is motor-driven and completely self-contained. The spindle is designed for an 8- by 3/4-inch grinding wheel, has a positive end thrust, and is driven by V-belts direct from the motor. The motor is mounted on a platform on the vertical slide, but an integral motor-and-spindle design is also available.

The base has vertical ways at the rear for the wheel-head, and horizontal ways on top for the saddle. Raising and lowering of the wheel-head are effected through a graduated handwheel. Wet-grinding equipment can be provided without increasing the floor space.

The hydraulic system is of the low-pressure type, the pump and its motor being an integral unit mounted inside the front cover plate. The table is propelled by a double-rodded piston, connected at each end and traveling in a cylinder attached to the saddle. Starting, stopping, and the speed of the table are all controlled by a single valve operated through a lever. The automatic cross-feed functions at each reversal or at alternating reversals, and is adjustable from 0.010 to 0.090 inch. It stops upon completing a traverse in either direction. The table stops simultaneously in the loading position.

Cylindrical Grinders Available in Various Models

The Type C cylindrical grinding machines are built in 10- and 16-inch sizes. The 10-inch size is available in standard lengths from 18 to 120 inches, and the 16-inch machine in lengths from 36 to 144 inches. The models are available with a hydraulic table traverse, a mechanical traverse, or a hand traverse. In addition, the 10-inch machines are available in semi-automatic models, and semi-automatic features can be built into the machines with hydraulic table traverse, if desired. Practically any model can be converted to any other of the same swing, a feature that minimizes the factor of obsolescence.

On these Type C machines, a motor mounted on a slide drives the wheel-spindle direct through V-belts without idlers or intermediate shafts. A spindle-reciprocating attachment can be built in or added later. Although the grinding wheel unit, complete with a 15-horsepower motor, weighs over 1 ton, the unit pressure on the ways is only approx-

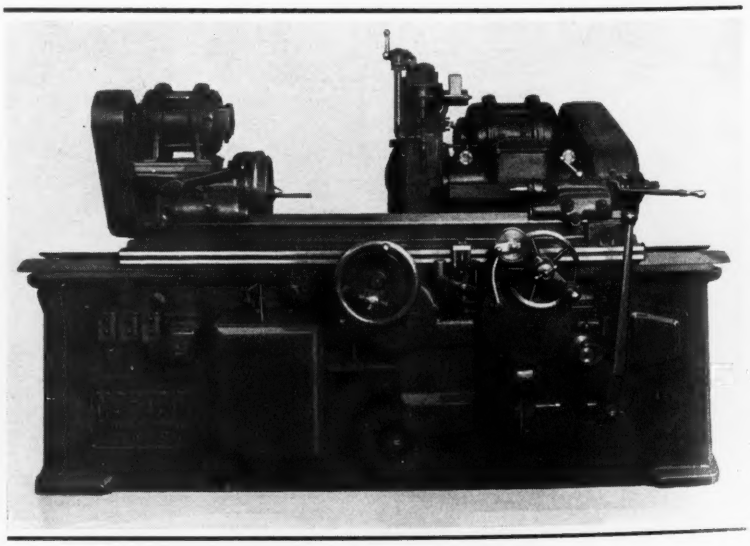


Fig. 4. Cylindrical Grinding Machine Equipped with an Electrical Sizing Device that Stops the Feed of the Grinding Wheel Automatically

imately 6 pounds per square inch. Two standard spindle speeds are quickly available by changing sheaves.

The hydraulically traversed machines employ a reverse valve that assures a positive reversal even at the slowest table speed. This feature is particularly advantageous in grinding rolls or other parts that must have highly reflective finishes. The table is actuated by two pistons in a single cylinder attached to the under side.

The semi-automatic models of the Type C grinder are specialized high-production plunge-cut grinders, in the operation of which the attendant simply loads the work and moves a single lever. They can be built with a hand or a hydraulic table traverse, a live-spindle or a dead-center headstock, a hand or a hydraulically operated footstock, an automatic mechanical or an electric sizing device, and can be adapted for practically any external cylindrical job by using fixtures instead of standard work-supporting units.

In the semi-automatic models, the grinding wheel is fed hydraulically at a rapid rate up to the work and then slowed down to a grinding feed. Several different feeds can be provided, the change from one to the next slower occurring automatically. A hydraulic wheel-head traverse is also available, which is particularly advantageous in grinding between high shoulders or flanges.

The "Nortonizer"—an Automatic Electric Sizing Device

The cylindrical grinding machine shown in Fig. 4 is provided with a gage that rides on the work as the grinding wheel feeds in. When the correct work diameter is produced, an electric contact is made which stops the feed of the wheel and automatically lifts the gage from the work. The wheel remains in contact with the work for a definite period, which is controllable within extremely fine limits. It then recedes rapidly to a position that facilitates quick reloading of the machine. This automatic electric sizing device is known as the "Nortonizer."

When this equipment is used on semi-automatic machines, the starting and stopping of the work rotation, the rapid travel of the wheel to the work, the feeding of the wheel during grinding, and the operation of the footstock and steadyrest, if these units are used, are all controlled automatically. As the operator need not be present when the work is finished, he can run several machines.

It is claimed that, by the use of this device, work can be ground hour after hour with a total clearance of 0.0003 inch. Compensation for wheel wear is unnecessary, since this factor has no influence on the finished size of the work. The "Nortonizer" can be applied to any new Norton cylindrical grinder and to practically all Type A or BA machines now in service. Round, splined, keywayed, or partial-diameter work can be ground in machines equipped with the device.

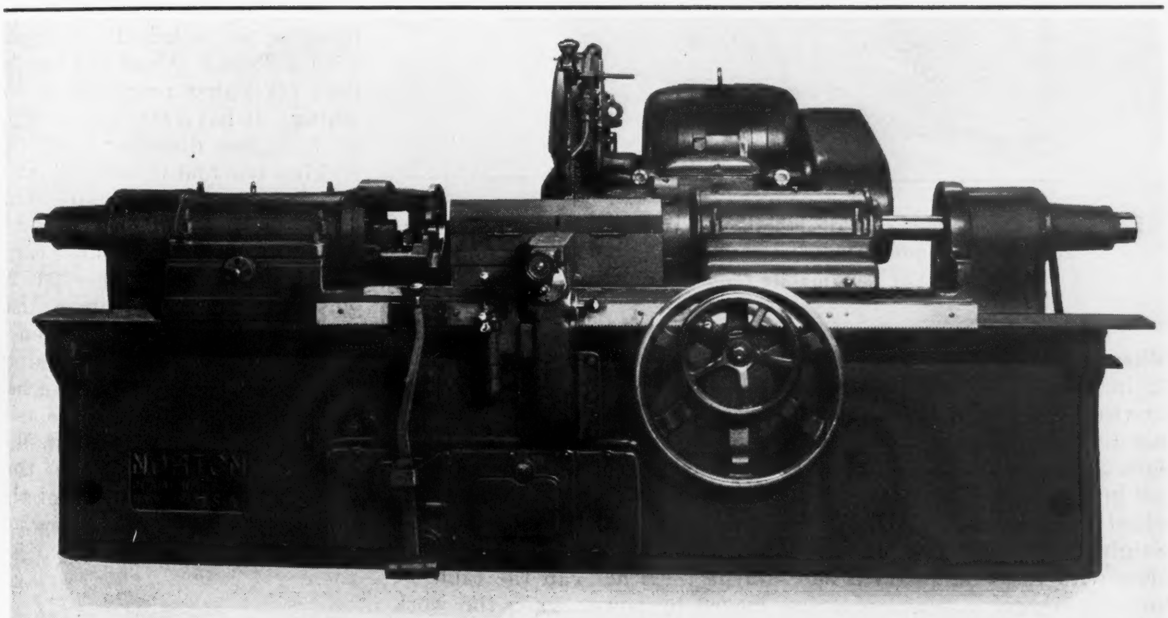


Fig. 5. Crankpin Grinder Built in Two Lengths to Accommodate Automobile Crankshafts from 28 to 52 Inches Long

New Crankpin Grinder is Provided with an Interlocking Control Lever

The D-85 crankpin grinding machine illustrated in Fig. 5 is built in two sizes, one size being intended for crankshafts from 28 to 40 inches in length, and the

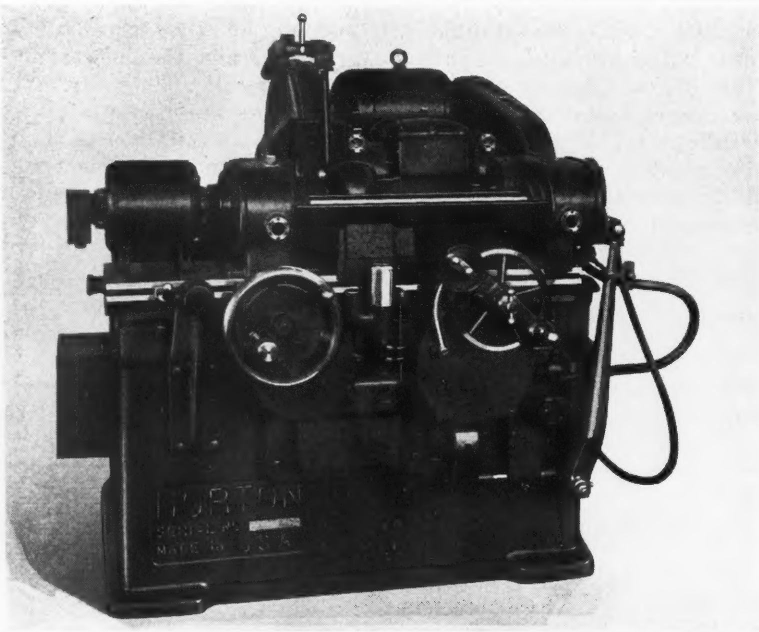


Fig. 6. "Cam-O-Matic"—a Machine that Performs Automatically the Movements Required for Grinding All the Cam Contours of Automobile Camshafts

other for crankshafts from 40 to 52 inches long. Both sizes have a swing of 17 inches, and use the same wheel unit that is supplied with 20-inch and larger Type D roll grinders. A 42-inch grinding wheel is standard, the wheel unit weighing over 3300 pounds, complete with its slide-mounted motor.

The grinding wheel is motor-driven through V-belts. Another motor drives the work from one end and the coolant and oil pumps from the other. This motor is enclosed in the base. The machine is of the double-head type, both heads driving the crankshaft. The left-hand head is fixed longitudinally, but has a lateral adjustment, while the right-hand head is fixed laterally, but is adjustable in a longitudinal direction. This flexible design simplifies retooling problems when automobile models are changed.

The wheel-head traverse and feed, the table travel, and the opening of the work-holder clamps are all hydraulically operated, the controls being through levers at the left of the operator. One of the features of the new machine is an interlocking arrangement of the main control lever that opens and closes the work-holder clamps, starts and stops the rotation of the work, and makes the table and wheel-slide control levers inoperative. The work-holder clamps cannot be opened when the work is rotating; neither can the table be moved by power when the work is rotating, the wheel-slide is advancing, or the steadyrest is in operation. Of the two handwheels to the right of the operator, the larger one is used for jogging the table to "split the spark," and the smaller one is used for feeding the wheel while grinding.

A Machine that Grinds All Cam Contours of Automobile Camshafts

All the cam contours of automobile camshafts are ground automatically in the machine shown in Fig. 6. Upon moving the starting lever, the table moves quickly until the first cam is in the grinding position. The work then starts rotating, the rocking bar is lowered, and the grinding wheel feeds in, first rapidly and then slowly at a grinding feed. When the cam has been ground to size, the wheel moves back quickly, and the table shifts to bring the next cam into the grinding position and to move the master cam roller to the next master cam. These movements are repeated for each cam. When the last one has been ground, the table moves into the truing position. Here the grinding wheel is trued automatically and compensation is made for the abrasive material that is dressed away. The machine then stops for reloading.

This "Cam-O-Matic," as the machine is called, is equipped with a Type C wheel and can be used for either roughing or finishing. It has a maximum swing of 6 inches diameter over the rocking bar and is built in three standard lengths for taking camshafts up to 30, 36, and 42 inches between centers. Master cams are furnished for either 24- or 22-inch wheels, a feature that contributes to economy when a battery of machines is used, since 24-inch wheels worn to 22 inches can then be transferred to machines equipped for the smaller wheels. The principle of this machine is similar to that of the Norton integral cam-grinding attachment.

Thor Boiler-Shop Drill

A Thor rotary type pneumatic tool designed to eliminate rough and broken threads and leaky staybolts in boilers has been developed by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. This tool is equipped with power blades instead of connecting-rods, pistons, and crankshafts, and is said to operate smoothly without any jarring or jerking effect.

The air consumption and speed are governor-controlled, so that racing of the motor is prevented when starting a tap. The tool has a drilling and reaming capacity up to 1 1/4 inches and a speed of 210 revolutions per minute. It is 12 inches long and weighs 28 pounds.

Lees-Bradner Automatic Hobbing Machine

The first of several new developments to be placed on the market by the Lees-Bradner Co., Cleveland, Ohio, represents an innovation in hobbing. It is an automatic machine of sturdy design which requires but 16 square feet of floor space. Gears up to 7 inches outside diameter and 8 inches face width can be cut, and teeth up to 4 diametral pitch can be cut in steel. The machine will cut straight or taper serrations, spline shafts, spur gears, wormwheels, and helical gears, right- or left-hand and with angles up to 45 degrees.

With this automatic machine, which is shown in Figs. 1 and 2, the operator merely loads the work and presses a button. The cutter then feeds in automatically at an accelerated speed to the full depth of cut, at which point the cutter-head registers against a positive depth stop. The cutter then feeds across the face of the work automatically at a constant speed. Upon the completion of the cut, the cutter automatically backs away at a rapid rate to clear the work for the return stroke.

The return of the cutter to the initial position shuts off both the motor and the flow of coolant, bringing the machine to a complete stop, ready for removing the finished work and inserting a new piece. A complete cycle of the machine has then been accomplished.

All bearings throughout are of the anti-friction type. Lubrication is automatic, a centrifugal pump delivering oil from the base through a filter to a distributor manifold at the top of the machine. From this point the oil flows by gravity through all bearings and over all shafts, gears, and moving parts on the machine. It then returns to the reservoir in the base for further use after it has again been filtered.

The tailstock is secured to the square ways of the column by means of taper gibs and clamps. It is actuated and clamped by a double movement of a single lever. All ways are of the square type and are of ample proportions. They are double gibbed and have a take-up to compensate for wear, thus insuring true alignment and continued accuracy of work.

The stop that controls the depth of cut is of the micrometer type, so that the depth of cut can be easily changed. The cutter-head is held rigidly against the stop throughout the entire cutting period. Depths of cut can be accurately controlled with this arrangement.

Chips are caught in the base, from which they can be easily removed by raising a panel at the rear of the machine. The splash guards, which are of an unusual design, keep the coolant within the machine at all times. Power is supplied by an individual motor through a fully enclosed Texrope drive. A three-horsepower constant-speed ball-bearing motor of the fully enclosed fan-cooled type is recommended by the manufacturer for driving this machine.

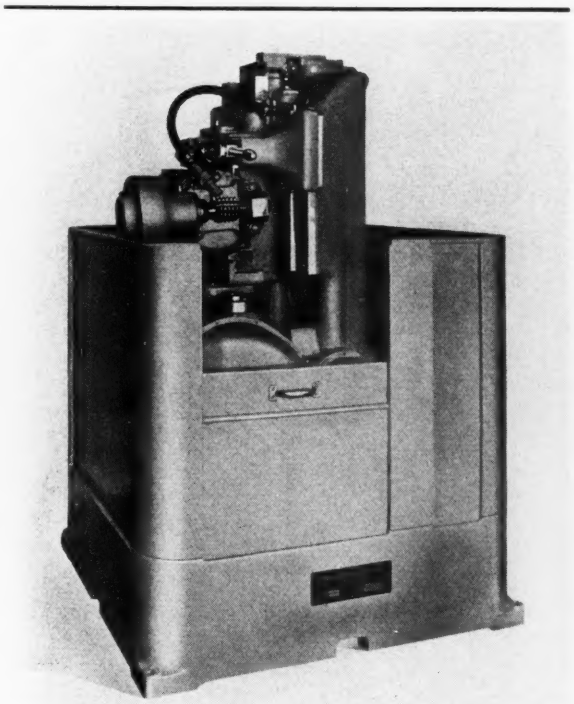


Fig. 1. Lees-Bradner Automatic Hobbing Machine which Occupies a Floor Space of Only 16 Square Feet

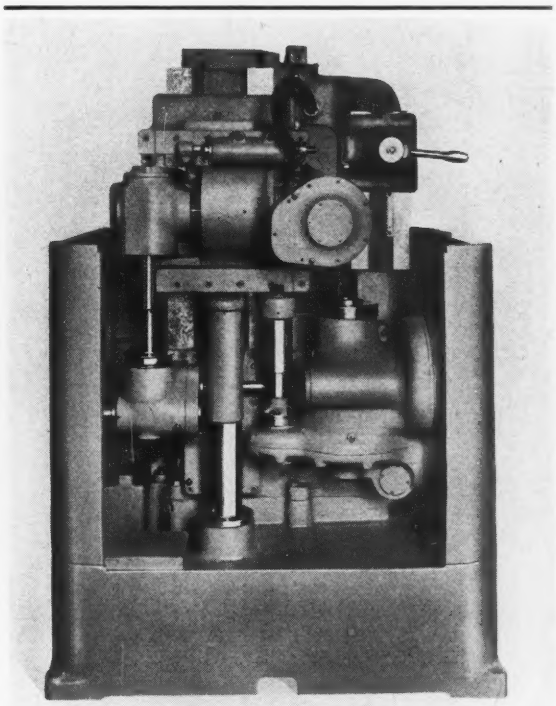


Fig. 2. Automatic Hobbing Machine with Guard Removed to Show the Arrangement of the Cutter and Work Units

Sundstrand Electromil and Improved Rigidmil

A small Rigidmil milling machine with an automatic electrical table control for the high-speed milling of parts used in business machines, household appliances, electric apparatus, firearms, small machines, and the like, has been developed by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill. This machine, which is known as the No. 1 Electromil, is designed to use unusually simple fixtures and can be set up or changed from one job to another so quickly that low-cost production can be secured with parts manufactured in small quantities. This machine is shown in Fig. 1.

Four horizontal plungers control electric circuits which energize solenoids to engage the feed or rapid traverse mechanisms or to reverse the table driving motor, as required. Dogs which slide in a T-slot on the table edge actuate the plungers. Each dog contacts with only one plunger. By this arrangement, changes in table movement can take place in rapid succession and less than 1/4 inch from the point at which the movement in progress was started.

Advantage can be taken of every opportunity to utilize the rapid traverse for the table, and the length of feed can be controlled within a few thousandths inch. Pushing a button replaces the pushing or pulling of levers, and thus physical effort on the part of the operator is reduced to the handling of work.

To facilitate setting up the machine, a group of four selector switches is located near the pick-off gears that control the feeding rate of the table. One switch provides a continuous automatic cycle of table movements or causes the table to stop upon the completion of each cycle. The second switch stops the machine spindle during the return of the work-table to the starting position or permits it to rotate continuously. The third one starts or stops the spindle. The fourth selects the direction of spindle rotation.

Two buttons, conveniently located, control the starting and stopping of the entire machine. The stop-button can be supplemented by a foot-pedal. After the operator has become accustomed to handling the work in process, the first selector switch can be turned to "automatic," so that the table movement will repeat its cycle continuously unless halted by operation of the stop-button or the foot-pedal. If additional time is required for changing the work pieces at the end of the cycle, the table movement may begin at the feed rate and then be changed to the rapid traverse when the new pieces of work have been secured.

The rate of rapid traverse in this machine is 400 inches a minute, and the feeds range from 1 to 80 inches a minute. Eight spindle speeds from 187 to 1125 revolutions per minute are available.

Improvements made over a

Fig. 1. Sundstrand No. 1 Electromil which has a Completely Automatic Electric Table Control

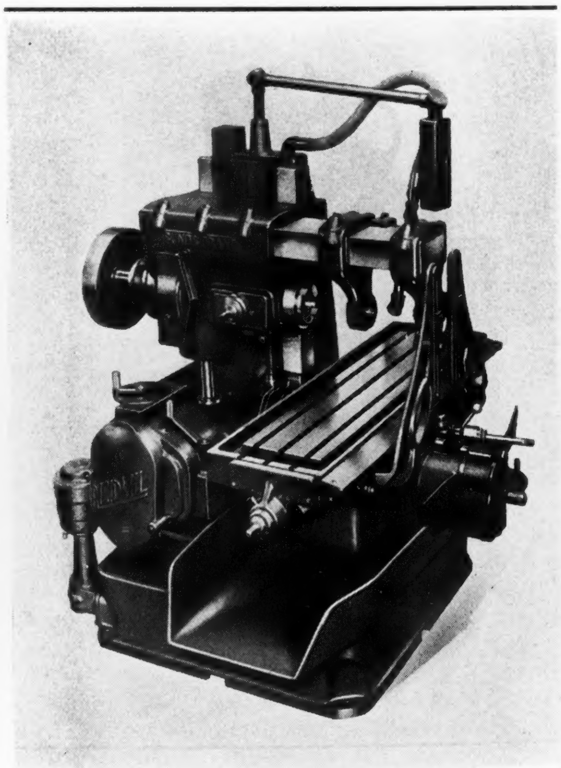


Fig. 2. Important Improvements have been Incorporated in the Model 3-A Rigidmil

period of time in building a large number of No. 3 Rigidmils have now been made standard in the model 3-A machine shown in Fig. 2. Simpler than the No. 3 in some respects, the new model has a broader field of application. It can be obtained with low-speed, medium-speed, or high-speed heads; vertical or horizontal spindles; and reciprocating or rotary tables.

The machine illustrated is equipped with a quick-change gear-box for the spindle speeds. By means of direct-reading dials, a total of twelve speeds is available, in two groups of six each. This gear-box may be mounted on the standard speed box instead of on the pick-off gear housing, if desired. Another quick-change feed box provides for twelve table feeds ranging from 0.74 inch to 29 inches per minute by merely operating one lever and a slide. The rate of rapid traverse is 250 inches per minute, as against 102 inches on the No. 3 model.

Electrical control of the machine is centralized in a pendent switch which can be swung to the position most convenient for the operator. This switch contains buttons for starting, stopping, "inching," quick-stopping, or "plugging," and for operating the coolant pump motor. The electrical cable to the switch is completely enclosed in the column.

Production Worm-Grinding Machine

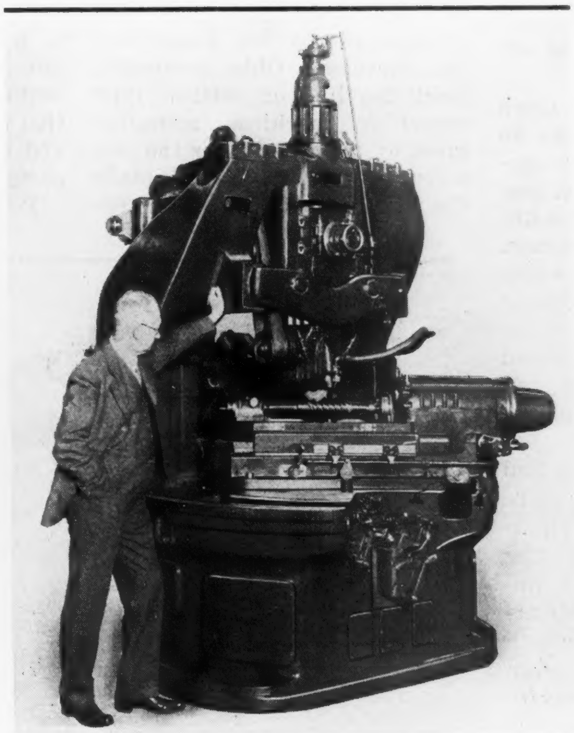
Right- and left-hand worms up to 8 inches in diameter, with helical angles up to 45 degrees, can be ground on a production basis in the machine here illustrated, which was built by the Gear Grinding Machine Co., Conant Road and Grand Trunk R. R., Detroit, Mich. Worms up to 12 inches long can be ground on shafts or arbors up to 22 inches in length. The worms may have threads corresponding to from 6 to 1 1/2 diametral pitch. Completely automatic operation of the machine is provided by hydraulic means.

In the operation of this machine, the worm revolves as it is fed lengthwise, so that the worm threads "screw" along the grinding wheel. The work-table is positioned at the proper helix angle relative to the wheel. The wheel is dressed or trued to grind the sides of two adjacent threads simultaneously. The linear movement of the worm is effected by a large lead-screw directly in line with the worm. This lead-screw must be of the same lead as the worm. Hydraulic power drives the lead-screw.

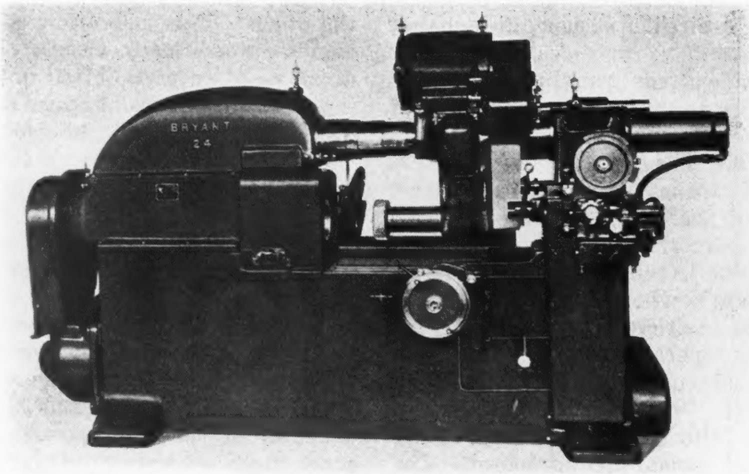
At the end of each traverse of the worm past the grinding wheel, the wheel rises and the work reverses its rotation, returns to its starting position, and indexes for the next thread. Then the wheel feeds down into position for the next traverse of the work. This operation continues automatically around the worm as often as required until the desired dimensions are obtained. Indexing of the worm and the vertical movements of the grinding wheel are both effected hydraulically. The up and down movement of the wheel is about 1 1/4 inches. In addition, the wheel can be adjusted 2 1/2 inches vertically to compensate for wear, thus allowing for a difference of 5 inches in the diameter of the grinding wheels.

Truing of the grinding wheel is accomplished by swinging the wheel-head on trunnions at the top of the machine so as to bring it near three diamonds, located at the rear directly in line with the wheel. The swinging of the wheel-head is effected by simply moving a lever to admit oil under pressure into a hydraulic cylinder. The shape of the wheel is controlled by a large templet at the rear, which has been worked out mathematically. In truing, the diamonds are actuated through a lever located at the front of the machine. The wheel is dressed once for each worm. The forward or grinding position of the wheel-head is controlled by adjustable stops.

On the machine illustrated, one motor is used for driving all units, but separate motors could be employed for the grinding wheel and for the hydraulic pump. An unusual feature of the drive is that while a belt transmits power to the grinding head, gearing actually drives the spindle. This construction was found necessary because of interference. Accurate ground gears, together with a combination of ball and plain bearings for the wheel-spindle, insure smooth rotation of the grinding wheel. The machine weighs 20,000 pounds.



Machine for Grinding Worms up to 8 Inches in Diameter on a Production Basis



Bryant Fully Hydraulic Hole Grinder which Embodies Many Improvements in Design

Bryant Semi-Automatic Hole Grinder

An increase in the weight of the bed casting from 3000 to 6000 pounds is one of a number of important improvements made in the design of the No. 24 semi-automatic hole grinder built by the Bryant Chucking Grinder Co., Springfield, Vt. The bed casting is made of box type to give maximum stiffness and rigidity. The wheel-slide bar is now made of steel and carburized and hardened.

The work-spindle is much heavier than before and has an improved mounting for ball bearings. This change makes it possible to use a heavier chuck without danger of spindle deflection. Power is supplied to the work-spindle through a simple Texrope drive, a multi-speed motor being usually furnished. There is an improved motor mounting and idler pulley arrangement for the wheel-spindle belt drive.

The hydraulic valve block and control has been moved to a more convenient position at the right-hand end of the machine. The valve mechanism has been improved with a shock absorber arrangement that gives a smooth reversal to the wheel-slide even at the highest speed. Pressure lubrication is supplied to the slide-bar bearings, which also aids in giving a smooth traverse to the wheel-slide. A hinge clamp in the slide box simplifies the inserting and removing of the grinding-wheel head. There is a separate Texrope drive for the pump of the hydraulic system.

The motor-driven coolant pump is mounted on a tank that is separate from the bed of the machine. This arrangement requires somewhat more floor space, but gives a greater coolant capacity and simplifies the cleaning and changing of the coolant. A filter is supplied for jobs requiring the highest grade of finish.

This machine is fully hydraulic in operation, the diamond-holder, cross-feed and wheel-slide lifter being controlled and operated hydraulically, in addition to the wheel-slide traverse. The various units are so interlocked that the operator has complete control over all motions by means of one lever. The work-spindle starts and stops automatically with the motion of the wheel-slide. When the slide is withdrawn from the grinding position to the right-hand end of the stroke, the work stops rotating. When the slide is again advanced to the left, toward the grinding position, the work automatically starts revolving.

Footburt Continuous Surface Broaching Machine

A surface broaching machine of horizontal design has been brought out by the Foote-Burt Co., Cleveland, Ohio, to supplement the line of vertical type broaching machines manufactured by the concern for the last seven years. In order to obtain the rigidity and strength necessary in surface broaching operations, the bed of the new machine is a one-piece, heavily ribbed, box type casting. One of the features of the new design is that the broach is held stationary and the work pieces are carried along the broach.

Power is supplied by a motor

Fig. 1. Footburt Horizontal Machine for Continuous Broaching

which is connected directly to a worm-shaft. Through worm-gearing and a helical gear reduction, the power is transmitted smoothly to a sprocket which drives a chain on which the work-holding fixtures are mounted. Oil in the drive housing submerges the lower portion of the drive gears and lubricates all moving parts of the drive.

The chain merely pulls the fixtures through a tunnel in which the broach-holder is mounted. In this tunnel, the fixtures ride in tool-steel guides as they pass the broach. This construction gives a rigid support to each fixture and makes the tunnel a solid structure. Adjustable wedges provide for setting the broaches.

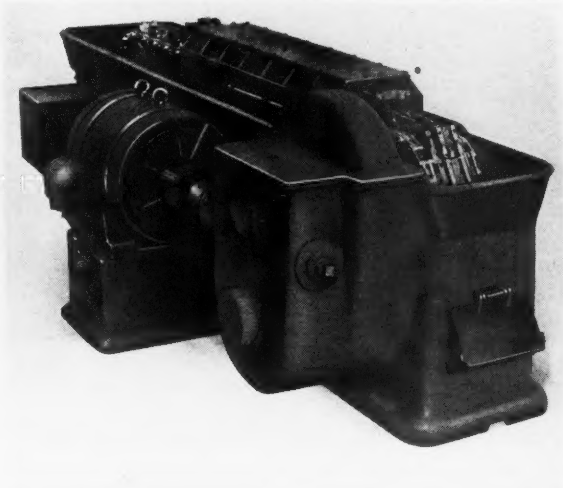


Fig. 2. The Drive to the Fixture Chain is through Worm and Helical Gearing and a Sprocket

Fixtures of the automatic clamping type are usually supplied, in which case the operator merely places the work in the fixtures. A cam guide positions the work properly, and the fixtures are automatically locked by a trip-hammer blow. After the fixtures have passed the broach, they are automatically released by a cam and the work falls into a chute at the left-hand end of the machine.

The machine is equipped with a push-button station for starting and stopping, and there is also a plugging switch by means of which the operator can stop the machine instantly if the occasion demands. Coupled to these switches is an automatic plugging switch located in front of the broach. Should the operator be careless in placing a piece of work in a fixture, the work will strike this switch and cause it to stop the machine immediately without damage to the tooling or to the machine parts.

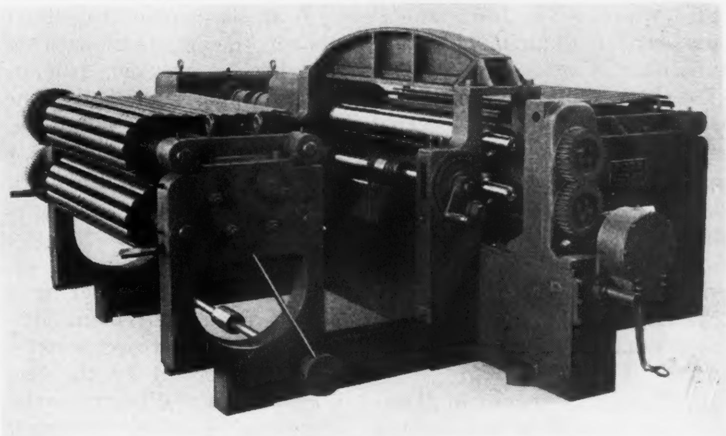
An abundant supply of coolant is pumped through jets positioned along the broach-holder to keep the work and tools lubricated and cool. It also washes chips from the broach teeth down through cored openings into the lower portion of the bed, which forms the coolant tank. The chips may be raked out through a door at the left-hand end of the machine. On the larger machines, a conveyor is provided for carrying away the chips.

Unusually long broaches can be used in this type of machine. The first teeth of the broach can be used as roughers for removing the major portion of the stock, while the remaining teeth can be used for finishing only. The cutting speed on the connecting-rod cap machine illustrated is only 25 feet per minute, it being stressed by the manufacturer that a slow cutting speed contributes to economical broach life. It is claimed that the broach will average about 50,000 cuts per grind. The connecting-rod caps are rough forgings and about 3/16 inch of stock is removed from the two joint faces and from the two end surfaces. The production is 1800 pieces per hour.

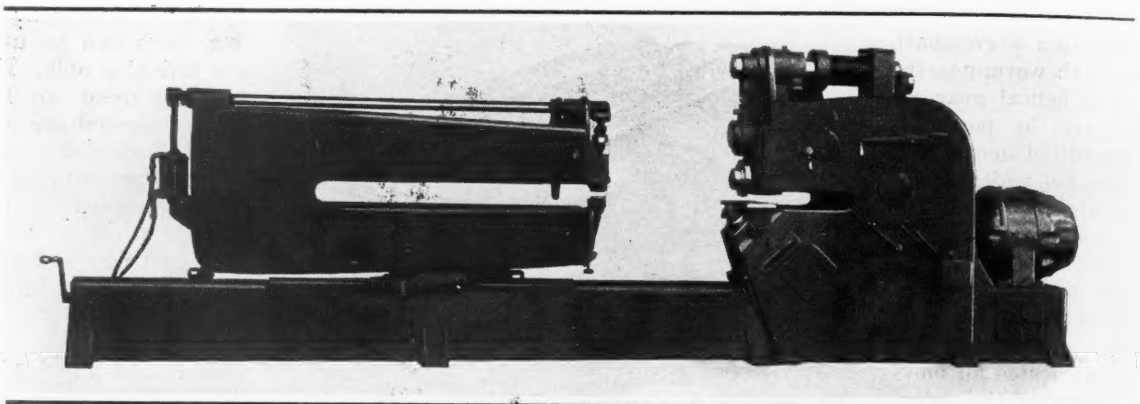
This broaching machine is available in three sizes—a No. 5 which has a capacity of 5 horsepower and accommodates broaches up to 30 inches long; a No. 10 machine which has a capacity of 10 horsepower and receives broaches up to 60 inches long; and a No. 15 machine which has a capacity of 20 horsepower and will take broaches up to 75 inches long.

Streine Conveyor Type Slitting Shear

A continuous hold-down slitting shear equipped with conveyors on both sides for feeding and removing the sheets has recently been designed by the Streine Tool & Mfg. Co., New



Streine Slitting Shear with Conveyors for Feeding the Sheets and Removing Them when Trimmed



Shear that Cuts Circles from Square Plates without Requiring Preliminary Cutting of the Corners

Bremen, Ohio. As may be seen in the illustration, the conveyor comprises endless roller chains, to which are attached half-oval slats made of either Bakelite or steel, depending upon the material to be handled. A yielding track under spring pressure forces the slats of the upper unit toward the lower unit, holding each sheet firmly as it is fed through the slitting cutters.

The rear conveyor can be moved back and the left-hand housing outward, as shown, by means of a rapid-acting screw to facilitate changing cutters. Provision is made to keep the axes of the cutter-shafts parallel. The cutter-arbors rotate in anti-friction bearings mounted in eccentric sleeves. The arbors are adjustable vertically by means of worm-gearing.

The scrap cutter of this machine consists of four rotating blades which sever the strip as it passes over an anvil roller. The anvil roller is adjustable relative to the cutting edges of the blades through a crank-handle, so that the cutter can be made effective regardless of the stock thickness. Adjustments as fine as 0.001 inch are possible and can be made while the machine is in operation.

Sheets of 38, 50, 62, and 74 inches maximum width can be handled. Four sizes of cutters—8, 12, 15, and 20 inches in diameter—can be used. A ball-bearing roller feed table with a quickly adjustable side gage is available for feeding sheets into the slitter.

Quickwork Mill Type Circle Shear

Circles can be cut from square sheets of steel of any thickness up to the capacity of the machine on the machine here illustrated without the necessity of first cutting off the corners. This machine was recently built by the Quickwork Co., St. Marys, Ohio, for the Inland Steel Co., Indiana Harbor, Ind. It will be used to cut circles in all gages of metal up to 3/8-inch mild-steel plate at a speed of 75 feet per minute. Circles up to a maximum diameter of 96 inches can be cut from square plates.

The cutters run continuously. The upper cutter is raised and lowered by a crank, actuated by a swinging member. Power is supplied by a 15-horsepower motor. The square plate is clamped pneumatically in the circle-cutting attachment. This attachment is based on the Quickwork laterally self-adjusting principle by means of which a true round head can be produced with a clean square edge from square plates.

The major parts of this machine are constructed from arc-welded steel plate. All shafts, with two exceptions, are mounted in anti-friction bearings, and all reduction gears run in oil. As a result of this construction, the entire machine can be easily turned over by revolving the motor pinion with one hand.

Societe Genevoise Desk Type Profile Projector

With the profile projector here shown, the image of articles being checked is thrown from below on the upper surface of a heavy glass plate, which is set in the top of a steel cabinet. This glass plate is inclined at an angle of 15 degrees, so that the operator can look directly at the projection without the shadow of his head or hands interfering with study or measurement of the image. This projector was recently developed by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, and is being introduced on the market in the United States and Canada by the R. Y. Ferner Co., Investment Bldg., Washington, D. C. The articles to be checked are mounted on a small table below the projecting condenser.

In addition to comparing the profile of screw threads and gears with their theoretical cross-sections, this equipment can be used for checking parts of watches, clocks, and typewriters, cutting tools, profile cutters, thread-rolling dies, and many other parts. Drawings can be made conveniently on the glass plate of parts for which drawings are not available. For this purpose, an adjustable protractor that slides along a ruler can be furnished for attachment to the desk.

Images can also be readily photographed by means of a frame, plate-holder, and black cloth.

The glass screen measures 12 1/2 by 15 3/4 inches. The magnification may be 10, 20, 50, or 100. Changes in amplification are made by merely pushing a new objective into place. The table on which the objects are placed consists of a glass plate 2 3/8 inches in diameter which can be rotated and adjusted crosswise for centering. The image can thus be quickly lined up with reference marks or an outline on tracing cloth or paper applied to the screen. The table is also quickly adjustable for height. A clamping device prevents any displacement after satisfactory focussing has been obtained.

Tracing paper or cloth laid on the glass plate reveals the image with enough sharpness to enable measurements of 0.005 inch to be made. With a magnification of 100, for example, such a measurement corresponds to 0.00005 inch on the object. Scales are provided for checking.

Sundstrand Three-Wheel Tool Grinder

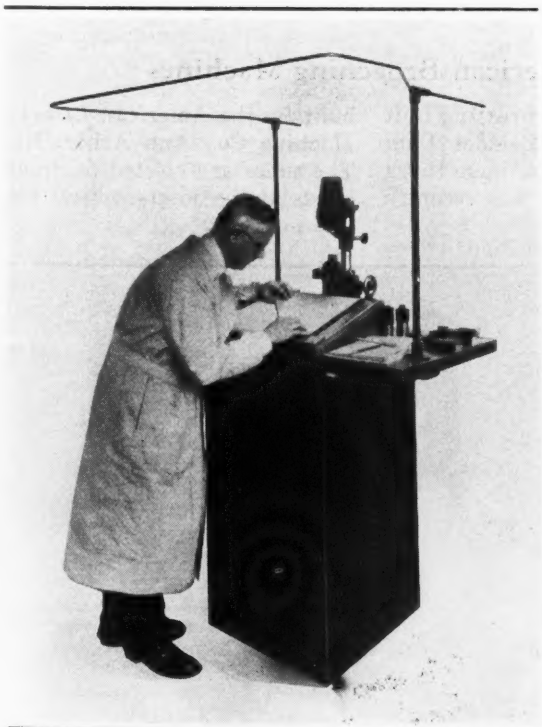
There are two grinding wheels and one honing disk on a machine developed by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., for sharpening tools of high-speed steel or of cemented carbide. The machine is available in three speed combinations. In one model, the speed of one spindle is suitable for grinding high-speed steel tools and the speed of the second spindle for grinding cemented carbide. Each grinding-wheel spindle is equipped with a wheel suitable for the material to be ground.

In the second model, the speed of both grinding-wheel spindles is suitable for grinding tungsten carbide. One spindle is equipped with a roughing wheel and the other with a finishing wheel. In the third model, both grinding-wheel spindles run at a speed suitable for grinding high-speed steel. A roughing wheel is provided on one spindle and a finishing wheel on the other. In all three combinations, the third spindle is equipped with a cast-iron disk for honing. The speed of the honing spindle is the same in all three combinations.

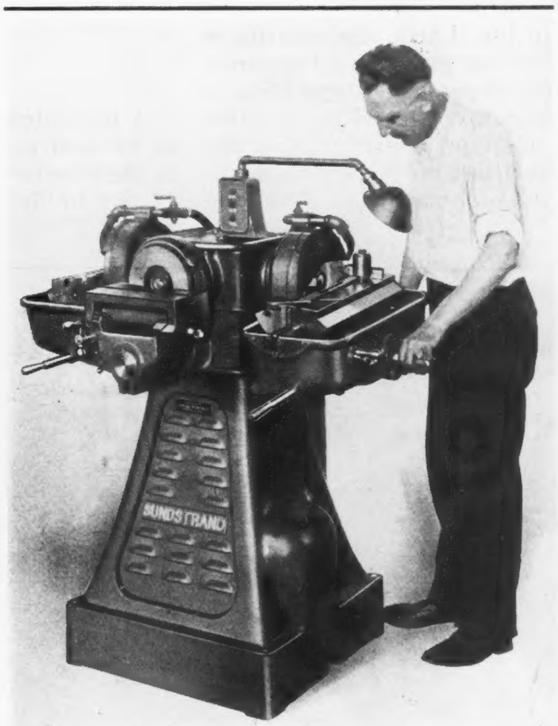
All three spindles are reversible so that right-hand or left-hand tools can be ground with the wheel or hone turning toward the cutting edge. With this construction, the edge being ground is always uppermost, in plain sight. Bars 3 inches in diameter support the honing and grinding tables. The honing table is adjustable through 40 degrees, and the grinding tables can be adjusted 40 degrees above and below the horizontal.

Handles are provided for traversing tools across the faces of cup-wheels. On the grinding tables, the tools can be conveniently clamped for grinding at any angle. The wheel guards are adjustable right and left.

Ten-inch cup-wheels are supplied as standard, and the cast-iron honing disk is 8 inches in diameter. The honing disk is impregnated with diamond dust.



Desk Projector for Checking the Profile of Screw Threads, Gear Teeth, and Other Elements



Sundstrand Three-spindle Machine for Grinding and Honing Carbide and High-speed Steel Tools

Motor Bases for Rockwood Drives

The Rockwood Mfg. Co., Indianapolis, Ind., has recently developed two new motor bases, one for use in vertical drives and the other for ceiling drives. The vertical drive base, which is shown in Fig. 1, provides a convenient means of adjusting belt tension to suit different loads. This makes it especially suitable for such machines as lathes, drilling machines, and grinders, which operate under widely varying loads, depending upon the work. For such machines it is undesirable to keep a constant tension on the belt. Changes in belt tension to suit heavier or lighter cuts are made within a few seconds by turning two nuts on the ends of coil-spring rods.

As in all Rockwood drives, the motor is mounted on two adjustable horizontal arms which are suspended from a pivot shaft. However, in this adaptation, the weight of the motor is counterbalanced by two coil springs which are connected by rods to the bracket arms. These springs provide the required belt tension.

In Fig. 1 this type of drive is delivering power to a high-pressure oil-pump for operating a large press. One of the features of this type of drive is that the correct belt tension can be maintained on both pulleys. When the motor is located above the driven pulley, the springs are adjusted to support the entire weight of the motor plus the necessary belt tension. When the motor is located below the driven pulley, the springs are adjusted to support only that portion of the motor weight that is not needed to provide belt tension.

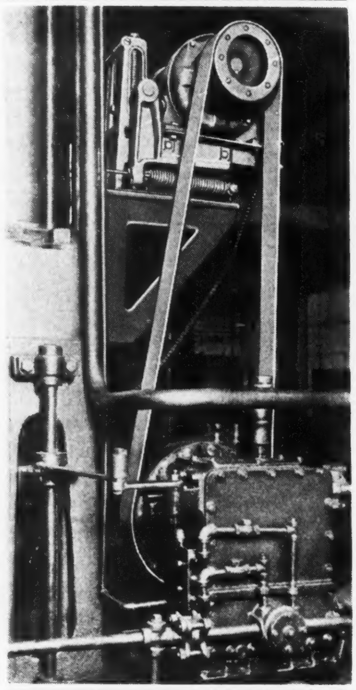


Fig. 1. Vertical Drive Base that Permits Quick Changing of Belt Tension

The ceiling drive base gives to ceiling drives the full range of tension adjustment available in the floor-mounting bases made by the concern. However, the belt tension adjustment can be made more conveniently than in the case of the ordinary horizontal drive. Once established, the proper belt tension is maintained by the motor weight.

As may be seen in Fig. 2, the ceiling drive base has hanger arms which suspend the motor horizontally. Adjustable steel angles which move horizontally on the hanger arms are supported by a ledge cast on the bottom of the arms. This ledge carries the weight of the motor, giving strength and safety to the motor support. The adjustable angles may be moved along the ledge by loosening screws and turning secondary arm screws. One man can quickly make any change in the belt tension.

American Broaching Machines

A broaching and pressing unit to be used at the Boulder Dam in the construction of huge tubes 13 feet in diameter was recently built by the American Broach & Machine Co., Ann Arbor, Mich. The tubes are riveted to circular bands at the joints. First holes

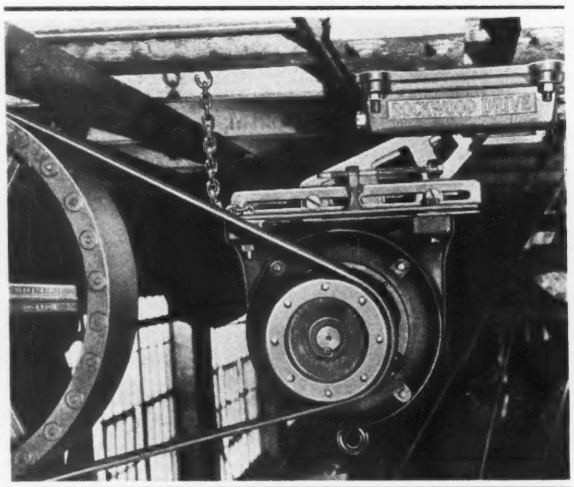


Fig. 2. Rockwood Ceiling Drive Base which Provides a Full Range of Tension Adjustment

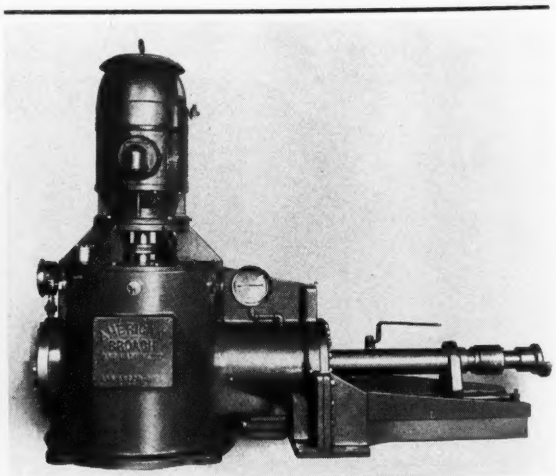


Fig. 1. Broaching and Pressing Machine Built for Use in Joining Huge Tubes at Boulder Dam

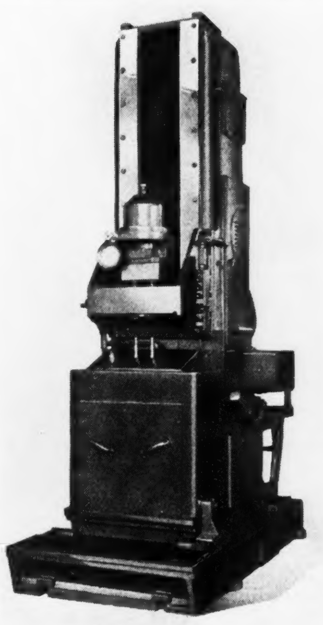


Fig. 2. American Combination Hydraulic and Mechanical Broaching Machine

are drilled through the tube and band, and then these holes are pull-broached by the machine. Next a rivet is pressed into each hole at pressures up to 40 tons.

This broaching and pressing equipment, which is illustrated in Fig. 1, is mounted directly opposite a drilling unit on a vertical turret which, in turn, is mounted on a carriage. The carriage is equipped with wheels for pulling along the inside of the tubes being riveted. Jacks are provided around the turret for clamping the carriage rigidly at the tube joints. The turret can be revolved through 360 degrees for drilling, broaching, and riveting at any point around the inside of the tubes.

The broaching and pressing machine is equipped with a hydraulic pump mounted in an oil reservoir, as in other broaching machines built by the same concern. Gages are supplied at both ends of the cylinder to enable direct readings of the pressures to be made. Automatic knock-off dogs govern the length of stroke. The machine is controlled by a four-way balanced piston valve which may be operated from either side of the machine. Without the motor, the machine weighs about 5400 pounds.

The same concern has also developed the HM-52 hydro-mechanical broaching machine shown in Fig. 2, which combines the advantages of both hydraulic and mechanical broaching. One of the main features is a cushioning device or hydraulic shock absorber which is automatically controlled.

This device provides a means of determining the total tonnage or pressure per square inch being exerted on the broach. It can be set for a predetermined pressure slightly above the maximum load. The broach has an opportunity to hesitate slightly as each tooth enters and leaves the work, thus giving a cushioning effect.

The cushioning device is provided with means for locking it in a solid position, so that the machine can be operated as regular mechanical equipment. This is desirable on extremely heavy cuts when only one or two teeth are in the work at a time, so that the load varies greatly as a tooth enters or leaves the work.

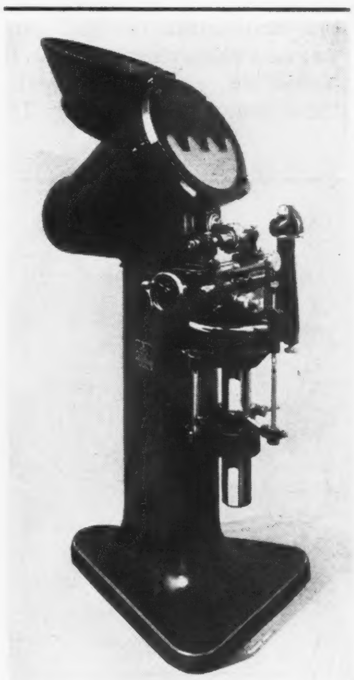
The machine is provided with a lower elevator for raising the broach, as in the case of all vertical pull-type broaching machines built by this company. This device is hydraulically operated. The machine is equipped with a push-button for starting the cutting stroke, another for starting the return stroke, and a third for stopping the machine. When a full-cycle operation is desired, a fourth button is depressed, and then when the starting switch is operated, the machine will go through the cutting stroke, discharge the work, and return the broach to the starting position, ready for the next cycle. Broaches up to 52 inches long can be used.

Pedestal Type Comparator and Measuring Machine

The Jones & Lamson Machine Co., Springfield, Vt., has added to its line of projection equipment the pedestal type comparator and measuring machine here illustrated. This machine can be supplied for comparing objects only or it can be provided with attachments for vertical, lateral, and angular measurements. It has been designed for tool-room, production, or laboratory inspection.

In using this equipment, light from a 50-candlepower Mazda lamp in a housing at the front of the machine passes through a pair of condensing lenses, across the object, and through a projection lens to a mirror, from which the shadow is reflected on a translucent screen, as shown. The screen, projection lens, and mirror are contained in the hood that is mounted on the machine column. The lamp housing is adjustable, so that the light beam can be thrown parallel to the helix of a screw thread or of a hob tooth.

All of the operating mechanism is within convenient reach of the operator when he is seated at the front of the machine. The upper portion of the ram which supports the table is threaded



Projection Comparator and Measuring Machine

and is encased in a 12-inch diameter ball-thrust handwheel which provides for a vertical adjustment of 6 inches.

Three styles of tables can be furnished—a plain table without lateral adjustment; a table with lateral adjustment for measuring 4 inches of spacing or lead; and a table with lateral adjustment for measuring 10 inches of spacing or lead. All three tables can be swiveled 15 degrees either side of the center. The table with 4 inches of lateral adjustment is mounted on balls and held against the end of a lead-screw by a weight. The table can be roughly adjusted with the lead-screw or it can be moved independently of the screw to permit inserting end measuring bars between a micrometer anvil and an adjustable anvil on the front of the table. Standard end measuring bars measure even inches, while the micrometer is used for measuring fractional dimensions. End measuring bars of special lengths, however, may be used for checking specific dimensions frequently.

For measuring vertically up to 2 inches, an indicator can be attached to the main casting and an anvil to the ram, with size blocks placed between them as shown. A vernier attachment used in conjunction with the graduated 16 5/8-inch diameter ring permits the accurate measurement of angles in degrees and minutes. A photographic attachment can also be supplied.

Provision has been made for inspecting by reflection objects having surfaces that cannot be projected. Lens systems can be supplied for from 12 to 200 magnification.

Hi-Eff Universal Static Balancers

Static balancers for flywheels, pump impellers, gears, and similar parts are being placed on the market in a number of models by the Taylor Mfg. Corporation, 2330 W. Clybourn St., Milwaukee, Wis. These balancers are of universal application in that parts of various shapes or sizes can be balanced in quick succession without changing the set-up. The only adjustment required is a turn or two of the threaded portion of the centering spindle. This can be done with the fingers. It adjusts the weighing fulcrum to the center of gravity of the part to be balanced.

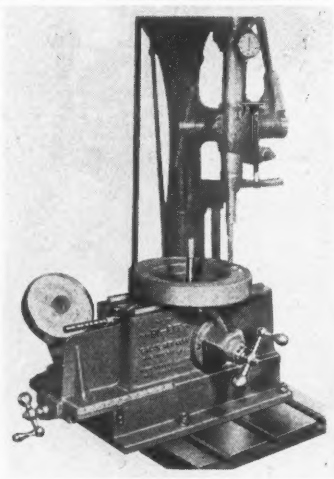


Fig. 1. Static Balancer with Calculator that Gives Number and Depth of Holes to be Drilled

Unbalance can be determined as closely as 0.01 ounce-inch on the smaller models and 0.1 ounce-inch on the larger. Standard models are built for handling parts as light as one ounce and as small as 1 inch in diameter, as well as for parts up to 48 inches in diameter and 600 pounds in weight. Larger models can be built special.

One of the features of these balancers is that the locating of the heavy spot in a part is accomplished almost instantly through the use of a sensitive spirit level. Weighing of the unbalance is done either by a hand-operated beam or an automatic dial. After the amount of unbalance has been determined, the number of holes to be drilled and their depth can be determined by means of the automatic calculator seen on the left-hand end of the machine in Fig. 1.

If the particular spot where the excess material is to be removed should prove to be so hard as to make drilling difficult or impossible, a crank can be turned to move the part to a new position. The automatic calculator will move in synchronism with the base and register the drilling data for the new position.

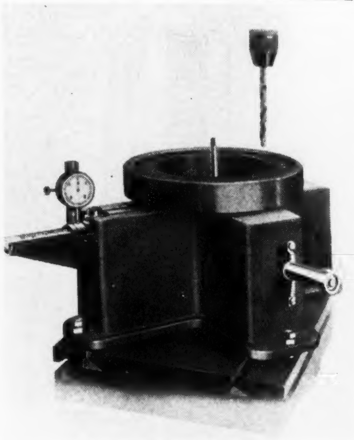


Fig. 2. Lever Type of Static Balancer for Light-weight Parts

The balancer shown in Fig. 1 is designed for use on any available drilling machine. It can be supplied with an integral base, vertical column, and overhead drill head for use in production lines. Models for balancing light-weight parts are of the lever type shown in Fig. 2. This type can also be supplied for use on any available drilling machine or for use in production lines. Another model has been developed primarily for balancing polishing wheels when the unbalance is compensated for by nailing lead slugs to the side of the wheel.

Fafnir Industrial Roller Bearings

The roller bearings recently placed on the market by the Fafnir Bearing Co., New Britain, Conn., for heavy-duty service in industrial applications are made in a comprehensive variety of sizes for shaft diameters from 3 1/2 to 7 3/8 inches, inclusive. These bearings were described in November MACHINERY, page 184. The range of sizes was given incorrectly in that description.

Monarch Tool-Room Surface Grinder

The Monarch Machine Tool Co., Sidney, Ohio, has developed the hand-feed precision tool-room surface grinding machine here illustrated. Among the features of this grinder is a built-in anti-friction bearing spindle unit made by the Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich., which was described in November MACHINERY, page 183. This spindle is driven direct by a one-horsepower motor that suits any alternating current requirements. Speeds up to 18,000 revolutions per minute are available.

Automatic forced-feed lubrication is supplied to all bearing surfaces, with the exception of the spindle bearings. The bearing surfaces are fully protected against dirt and foreign substances, flat steel pieces protecting the sliding surfaces of the spindle carrier and the column bearings, as well as the space between the base and the saddle. The saddle V-ways and the table ways are protected by closely fitting drawn-steel angle-pieces.

All castings, with the exception of the cabinet base, are normalized to prevent distortion in use. A three-point bearing between the cabinet base and the grinder base eliminates strain. To prevent backlash and insure smooth table travel lengthwise, thus eliminating marks on the work, the table is actuated by an adjustable roller chain and sprockets.

Monarch Surface Grinder with High-speed Spindle

An adjustable nut on the spindle-elevating screw compensates for wear of the wheel and prevents backlash. The spindle-elevating handwheel is graduated to 0.0005 inch. The design of the spindle carrier and column bearings is such as to eliminate wear and promote accuracy. Easy operation of the machine is another advantage, both the traverse and cross-feed handwheel shafts being mounted in anti-friction bearings.

The base of the machine is fitted with an oil reservoir which is conveniently filled from the outside. A high-pressure pump supplies oil automatically through metering pins to all surfaces and parts requiring lubrication, just the right amount of oil being delivered to each. This pump is operated from a cam on the cross-traverse handwheel.

Porter-Cable High-Speed Universal Milling Machine Attachment

A high-speed attachment for power-feed milling machines which is intended for use in any tool-room, jobbing shop, or manufacturing plant has been brought out by the Porter-Cable Machine Co., Syracuse, N. Y. This No. 6 attachment can be employed for such awkward operations as milling internal or external cams; boring holes in jigs and fixtures without changing the position of the work; and milling drafts on patterns. It is also suitable for milling radial and angular surfaces, T-slots, etc.

The universal head of the attachment will operate at any angle in any plane. Regardless of the cutter position, the attachment is held rigidly by the over-arm clamp. Preloaded precision bearings that take both radial and thrust loads are used throughout. All bearings and gears are totally enclosed and run in oil.

High-speed Universal Attachment for Milling Machines

The attachment is driven by the spindle of the milling machine and provides a spindle speed of 2 1/3 times that of the machine spindle. It is adaptable to any make of single or double over-arm milling machine. A No. 9, 10, or 11 Brown & Sharpe taper drive-arbor is supplied, while the attachment spindle is made with a No. 7 Brown & Sharpe taper socket. A split draw-in collet can be furnished for holding small end-mills.

High-Speed Grinder for Track Joints

A high-speed machine has been developed by Cyril A. Fox, 1703 Oliver Bldg., Pittsburgh, Pa., for grinding railway tracks. In operation, the axis of the grinding wheel is positioned obliquely to a transverse line across the rail, so that all marks made by the grinding wheel are at an oblique angle to the direction in which the car wheels travel. This eliminates all transverse irregularities on the rail surfaces and the consequent hammer-like blows caused by car wheels dropping into depressions, which are said to result from the ordinary grinding procedure in reconditioning railway tracks.

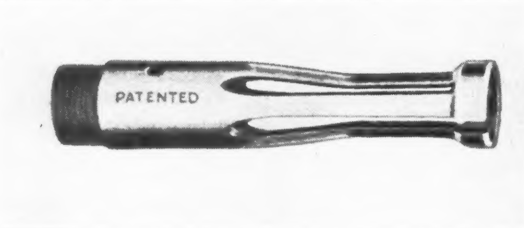
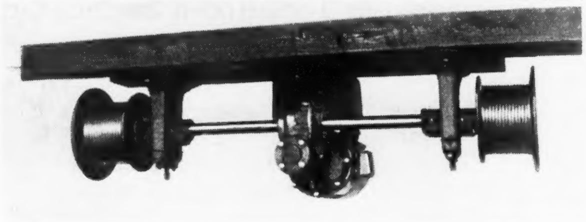


Fig. 1. Stock Pusher which can be Tightened when Worn



Electro Lift Hoist Equipped with Twin Drums and Hooks

Screw Machine Pushers, Finger Holders, and Cams

Several products of particular interest to users of screw machines have been developed by the Modern Collet & Machine Co., 401 Salliotte St., Ecorse, Mich. These include stock pushers of the design shown in Fig. 1, equalizing finger holders such as illustrated in Fig. 2, and cams made of alloy steel. The design of these stock pushers is such that the same pusher can be used for both round and hexagonal stock or for both round and square stock.

Another advantage of these pushers is that they can be tightened to any desired tension when they become loose through wear. The adjustment can be made without special tools.

The feature of the equalizing finger holders is that the load is distributed to three points instead of to only two, as is usual. The thrust plate is self-adjusting, so that the fingers carry equal loads, thus reducing breakage to a minimum. The collet and collet tube are moved backward or forward in a true straight line, so that all of the locking power is applied directly to the collet. This is claimed to give a tighter grip with less power consumption.

The alloy steel cams are intended to replace cams made from iron or steel castings. The new cams are made of S A E 6145 steel, and heat-treated to give long life.

Electro Lift Twin-Hook Electric Hoists

Electric hoists equipped with two drums and hooks, as illustrated, to facilitate lifting long or bulky loads, furnace doors, sections of monorail track, etc., have been placed on the market by Electro Lift, Inc., 30 Church St., New York City. These hoists are made in capacities of from 500 to 6000 pounds. They can be readily suspended, as shown, or mounted on a trolley that runs on a monorail track. These hoists can be supplied for operation on direct current and polyphase or single-phase alternating current.

The two drums operate together, being mounted on an extended shaft which may be of any length to permit spacing the hooks to meet requirements. Either a rope control or an automatic push-button control can be furnished.

Tasco Circular Slide-Rule

A metal circular slide-rule designed to be carried in the vest pocket has been placed on the market by the Tavella Sales Co., 25 West Broadway, New York City, under the trade name of Tasco. This rule is made of nickel silver disks, with the lines and figures etched in black. It is grease- and water-proof, and should the instrument become soiled, it can be easily washed with soap and water. An advantage of this slide-rule is that it can be dropped, trampled on, or immersed in liquids without being damaged or the accuracy lessened.

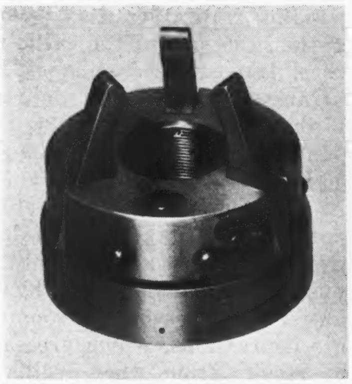
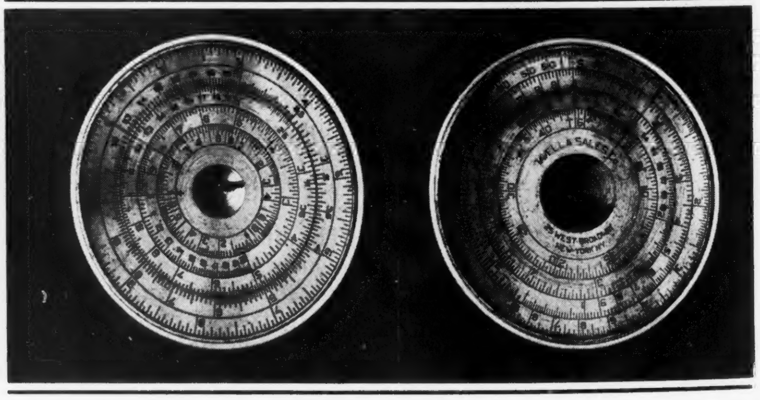


Fig. 2. Equalizing Finger Holder



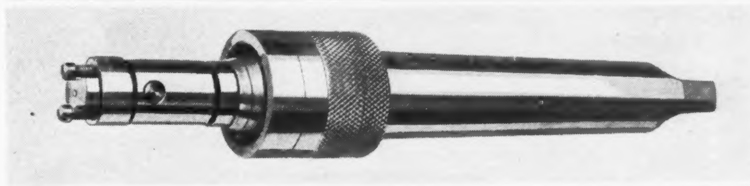
Opposite Sides of the Tasco Nickel-silver Circular Slide-rule

The outside diameter of the rule is under 3 inches. The length of the multiplication-division scale is 6.3 inches as against 5 inches on the A scale of a regular 10-inch slide-rule. The front side of the slide-rule, which is shown at the left, has five scales, including the "Log," C, D, CI, and K scales. The reverse side, shown at the right, has sine and tangent scales, as well as A and D scales for squares and square roots.

Wrigraph Drafting Block

A drafting board with a parallel device and drawing attachment, the entire outfit being small enough to carry in a brief-case for use in the field, on the train, at home, or in the office, has been developed by L. G. Wright, Cleveland, Ohio, and is being placed on the market by the Fletcher F. Milligan Co., 4630 Prospect Ave., in the same city. The board is made of 3/16-inch thick Masonite. It is provided with clips that will hold either a single sheet or a pad of letter-sized paper.

The parallel device is constructed of nickel-plated arms, a connector, and wrist plates. Either of two drawing attachments can be provided. One is a combination 30-, 60-, and 45-degree triangle, by means of which angles of 15, 30, 45, 60, and 90 degrees can be drawn. The right-angle sides are graduated to 1/8 or 1/10 inch and provide edges for drawing horizontal and vertical lines without shifting.



Full-floating Universal Arbor Made by the Mid-State Mfg. Co. for Horizontal and Vertical Reaming Operations

The other drawing attachment consists of a protractor and a graduated straightedge which can be set to any angle required, in degrees.

Full Floating Arbor with Universal Movement

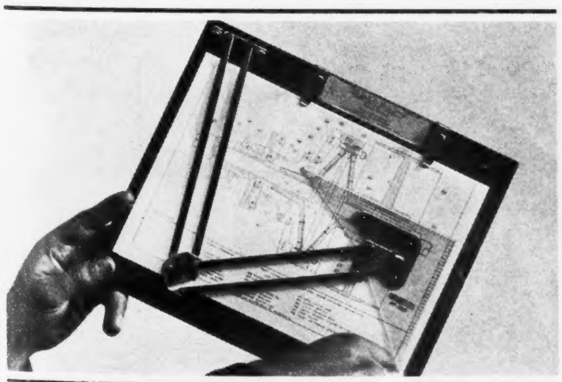
The Mid-State Mfg. Co., Waupun, Wis., has brought out a full floating arbor with a universal movement. This arbor is intended for use in vertical and horizontal reaming operations and can be employed in automatic or hand screw machines, turret lathes, drilling machines, and other types of equipment. The construction is such that the tool will follow the hole in a true line, even when machines are badly out of alignment, thus resulting in round, straight, and accurately sized holes.

Another advantage of this arbor is that it can be changed from a rigid arbor to one having a full float with universal movement, or vice versa, while the machine is in motion. Standard arbors with adapters will accommodate all kinds of standard shell reamers in sizes from 1 1/2 to 6 inches. Special adapters are made for all makes of reamers.

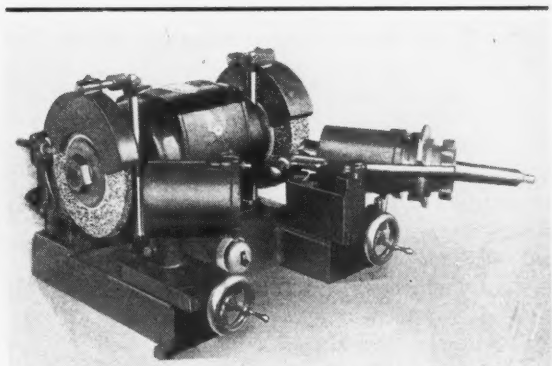
Wells Drill Sharpener

Drills from 1 to 2 1/2 inches in diameter can be sharpened and rounded in the Model No. 26 drill sharpener recently added to the line of tool grinding machines made by the Wells Mfg. Co., Greenfield, Mass. In this machine, correct alignment of the drill is insured by holding it in a double-end collet. Cams are employed to give any amount of relief desired.

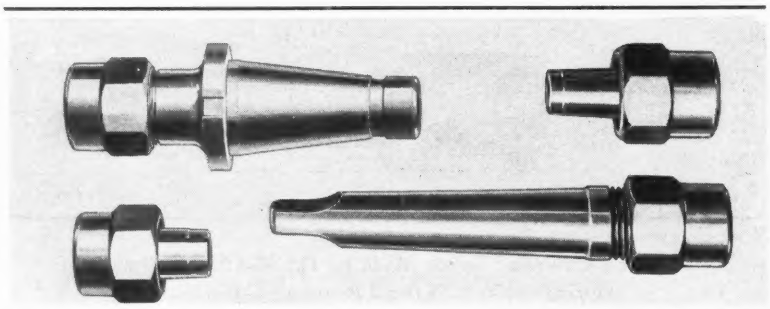
The right-hand end of the machine is used for sharpening drills and giving the proper eccentric relief, while the left-hand end of the machine is employed for rounding the drills on the corners to give them an easy cutting action and insure a correctly distributed load. The equipment is driven by a 1/2-horsepower motor. It can be furnished with a base or for bench use as illustrated.



Drafting Board and Machine Small Enough for the Brief Case



Grinder for Sharpening, Relieving, and Rounding Drills



Several Styles of Palmgren Collet Chucks

Palmgren Collet Chucks

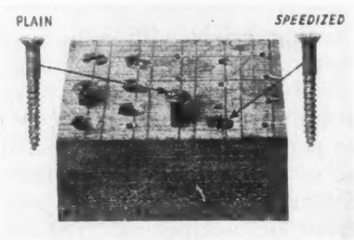
Collet chucks designed for holding straight-shank drills, taps, reamers, and end-mills are being introduced on the market by the Chicago Tool & Engineering Co., Inc., 8389 S. Chicago Ave., Chicago, Ill. These chucks are suitable for close-center multiple-spindle operations. In each case, the collet and nut are so interlocked that unscrewing of the nut automatically releases the collet. This feature eliminates the necessity of drifting drills and chucks out of spindles or providing a set-screw in the holder and ground flats or grooves on drill shanks.

The Palmgren collet chucks are made with Morse taper shanks and with threaded or tapered bodies to fit machine spindles. They are made with Brown & Sharpe shanks for milling machines and straight round shanks for turret lathes.

"Speedized" Wood Screws

Wood screws that can be driven home with unusual ease are being placed on the market by the Elco Tool & Screw Corporation, 1800 Broadway, Rockford, Ill., under the trade name of "Speedized." These screws are exactly like ordinary wood screws in size, shape, and style of thread. However, they have been treated to give them easy driving qualities.

The illustration shows a block of hard wood into which a number of holes were drilled slightly smaller than the standard size for the diameter of the screws that were to be driven into the block. "Speedized" screws were then easily driven in until the heads were flush or below the surface of the block, while the heads of ordinary screws could not be driven flush.



Wood Block that Demonstrated the Easy Driving Properties of "Speedized" Screws

Oxweld Straight-Line and Pipe Cutting Machines

A straight-line cutting machine recently added to the Oxweld line of welding and cutting apparatus manufactured by the Linde Air Products Co., 30 E. 42nd St., New York City, is shown in Fig. 1. This machine is intended for trimming and beveling plates. It consists essentially of a steel channel supporting base, a means for moving the blow-pipe, and adjustments for setting the blow-pipe to cut bevels. Motion is provided in two directions—45 inches longitudinally and 7 3/4 inches laterally. The machine can be furnished either with two traversing handwheels for hand operation or with one handwheel and a universal motor. Either the handwheel or the motor can be used by simply throwing over a lever.

The same concern has also brought out the machine illustrated in Fig. 2 for cutting and beveling pipe. Three spreading arms on the center rod are pressed against the inner wall of the pipe to hold it in position. The blow-pipe on the outer arm can be adjusted to any angle. Both the blow-pipe and the arm can be rotated without the use of the crank for centering the device quickly. The crank is used for rotating these members in the actual cutting of a pipe.

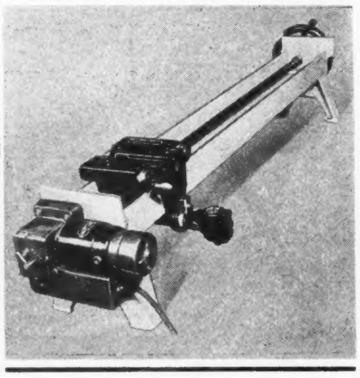


Fig. 1. Oxweld Machine for Trimming and Beveling Plates

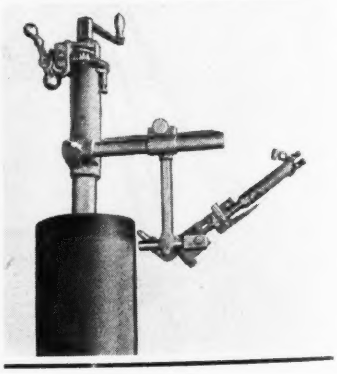
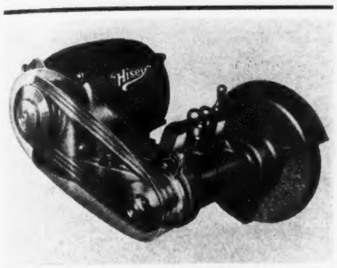


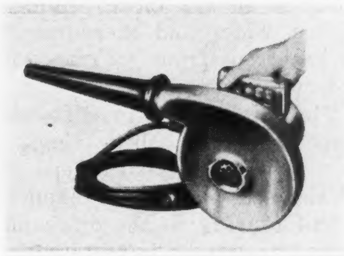
Fig. 2. Blow-pipe Machine for Cutting and Beveling Pipe

Hisey Wide-Range Precision Grinders

Motor-driven grinder units that are readily adaptable for use on lathes, boring mills, planers, milling machines, etc., have been placed on the market by



Hisey Precision Grinder for Application to Machine Tools



Tornado Blower for Removing Dust from Motors and Machines

the Hisey-Wolf Machine Co., Cincinnati, Ohio. These grinders are made in five sizes, ranging from 1/2 to 5 horsepower in capacity. They are equipped with wheels from 6 by 3/4 inch up to 14 by 2 inches. Wheels of any shape can be employed.

These grinders can be used for the many odd jobs that come up in machine shops, such as grinding rolls, bearings, journals, tapers, mandrels, cutters, dies, surface plates, and bushings. They are also suitable for production work.

A feature of these grinders is that they operate at practically the same speed under any load within their rated capacity, being equipped with constant-speed motors. The motor drives the wheel-spindle through multiple V-belts. One advantage of the drive is that any roll that can be swung over the carriage can be ground in most lathes. Another advantage is that various spindle speeds are obtainable by merely changing the pulleys. The wheel unit is mounted on a slide which is adjustable to and from the work by turning a handle.

Tornado Portable Electric Blower

A Tornado Model 10 electric blower has been added to the line of portable electric blowers made by the Breuer Electric Mfg. Co., 852 Blackhawk St., Chicago, Ill. This device, which is shown in the accompanying illustration, is intended for blowing dust out of motors, machines, parts of all kinds, stock-rooms, storage spaces, etc. It can also be employed for spraying insecticides. The blower is driven by a one-horsepower ball bearing motor.

Motor with Built-in Capacitor and Automatic Cut-out Switch

Louis Allis Self-Contained Capacitor Motor

A built-in capacitor and an automatic cut-out switch are features of a new line of capacitor start, single-phase motors being introduced to the trade by the Louis Allis Co., Milwaukee, Wis. The capacitor is of the coil-wound type. It is so located that cooling air constantly passes between it and the motor so that the motor heat is not radiated to the capacitor. This tends to prolong the life and efficiency of the motor.

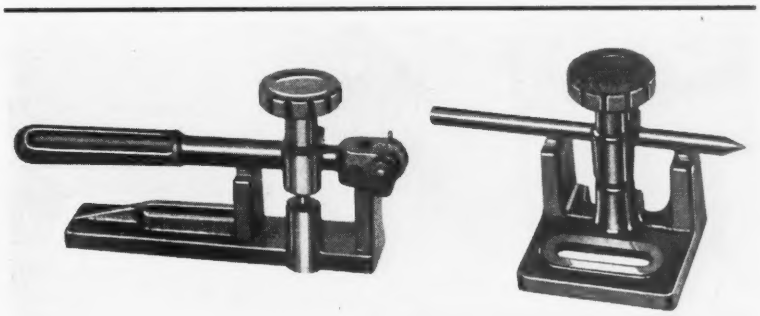
An automatic centrifugal switch cuts out the capacitor at the correct speed, and is not affected by variations in the voltage or in the starting load. This motor is now available in sizes from 1/3 to 3 horsepower and in both horizontal and vertical types.

The same concern has also developed a complete line of enclosed self-ventilating arbor motors ranging in size from 2 to 10 horsepower. These motors are especially adaptable for applications in which the space for mounting is limited.

Graham Emery-Wheel Dresser Holders

The two styles of emery-wheel dresser holders here illustrated are intended for use on many kinds of standard and special grinding machines. These holders have been designed by the Graham Mfg. Co., 71 Willard Ave., Providence, R. I., to meet a great variety of conditions, one style being made with a long base and the other with a square base. Both styles have bolt slots so that they can be conveniently attached to the table or other member of a grinding machine.

The upright projections of the holders are made V-shaped on top to accommodate Huntington type dresser handles, as shown at the left, or to take ordinary round-shank diamond-holders, as



Graham Emery-wheel Dresser Holders Designed to Meet Many Grinding Machine Requirements

illustrated at the right. The holders intended for Huntington style dressers have flat shoulders for supporting the dresser close to the cutters. The tops of these upright projections can also be made to suit any special type of dresser handle. The dresser handle is clamped in place by turning a knob.

The center of ordinary dresser cutters is about 3 inches above the bottom surface of the holder. The base shown at the right is 4 1/4 inches square, while the base of the long holder is 2 inches wide by 9 inches long.

Delta Bench Type Drilling Machine

A floor type drilling machine that can also be used for routing, mortising, and shaping in wood was described in December, 1932, MACHINERY, page 298, at the time that it was being introduced on the market by the Delta Mfg. Co., 3775 N. Holton St., Milwaukee, Wis. The company is now bringing out a bench model of the same machine, as shown in the illustration. The new machine is 36 1/2 inches high, 10 inches wide, and measures 21 inches from front to rear with the motor installed.

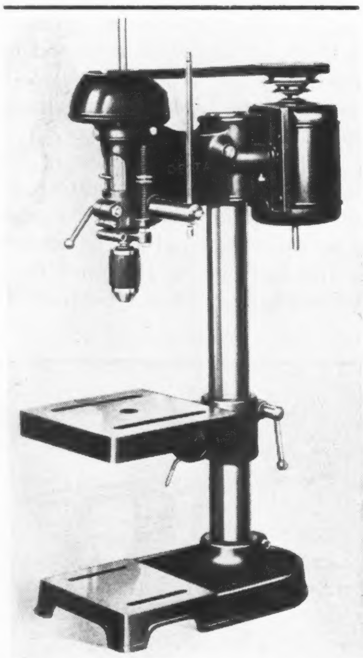
The spindle runs in self-sealed New Departure ball bearings. It is of the free-floating type, all of the belt pull being taken by a ball bearing in the drive pulley. The spindle is fitted with a patented Delta-Grip chuck of the self-tightening type, which has a capacity for 17/32-inch drills. Interchangeable spindles are available, one fitted with a Jacobs chuck, another designed for holding No. 1 Morse taper drill shanks, and a third for woodworking bits having standard 1/2-inch shanks.

Excess-temperature Cut-out for Heating Apparatus

Hevi-Duty Excess-Temperature Cut-Out

Overheating of all types of gas, oil, or electrically heated apparatus can be prevented by means of an improved excess-temperature cut-out recently brought out by the Hevi Duty Electric Co., Milwaukee, Wis. This device can be set to cut out at a few degrees above the normal operating temperature of the equipment.

A separate thermo-couple located in the heating chamber operates the cut-out control relay. This relay is connected to form part of the main heating control circuit. As soon as the temperature for which the instrument is set is reached, the control circuit is opened and the heat source shut off.



Bench Machine that can be Used for Drilling, Routing, Mortising, and Shaping

Landis Hardened and Ground Die-Heads

In the description of the die-heads made by the Landis Machine Co., Inc., Waynesboro, Pa., which were illustrated in November MACHINERY, page 178, some mechanical details were omitted which are of special interest. In these die-heads, made from alloy steel, the chaser-holders, which operate in dovetail slots ground in the head body, have an unusually wide bearing surface consisting of the combined areas of the base and the dovetail section of the chaser-holders. The driving member of the die-heads—the shank or attaching flange—drives the head body directly, so that no torsional strains are transmitted to the adjusting, locking, or opening and closing mechanisms.

The head-opening action is obtained by moving the chaser-holders away from the work. The position of the chaser-holders is controlled by prongs that are integral parts of the closing ring. The supporting surfaces of these prongs act as cams, and as a key in the chaser-holder slot fits into a keyway in the prong, the action of the chaser-holders, both to and from the "closed" or "locked" position, is positively controlled. The spring pressure actuating the movement of the closing ring acts directly upon the closing ring itself; this insures uniform head-opening action. An additional feature is that four offset surfaces on the front of the locking ring which controls the movement of the closing ring hold the latter in the "locked" position.

The mechanism for adjusting the die-heads to size consists of a threaded collar which screws on the head body and which is in direct contact with the locking ring. The adjusting ring can be locked in position after the size

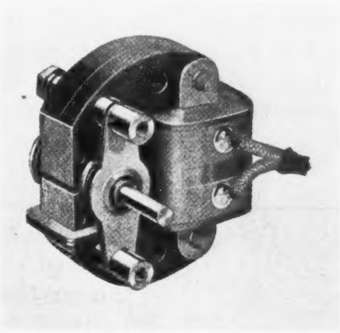
adjustment has been made. The ring is graduated for adjustments of 0.001 inch in the pitch diameter of the thread, but adjustments as close as 0.00025 inch are possible. The cutting torque cannot be transmitted to the adjusting ring.

A comparatively short chaser-clamp seats in a socket with a tapered bottom. When the clamp is drawn down, the clamping action is toward the base and back of the chaser-holder, thus seating the chaser firmly. A lip extending along the top of the chaser-holder, and protruding slightly beyond the front of the clamp, supports the cutting edge of the chaser and prevents it from being thrown out of alignment.

These die-heads can be employed for cutting both right- and left-hand threads by using the proper chaser-holders. The same chasers are used for right- and left-hand work by grinding the cutting angles at both ends of the chasers. In setting the chasers to the correct position, a chaser-setting gage, similar to a straightedge, is laid on a ground surface on the side of the chaser-holder adjacent to the cutting edge of the chaser. The chaser is then moved forward in the chaser-holder by means of an abutting screw, until the cutting edge of the chaser touches the side of the gage.

Speedway "Flea-Power" Motors

Two motors so small that they fit comfortably in the hand and weigh only about a pound each have been developed by the Speedway Mfg. Co., 1834 S. 52nd Ave., Cicero, Ill. They are designed for a large variety of applications, such as driving fans, small tools, display signs, toys, vending machines, and operating mechanisms. The motor illustrated is



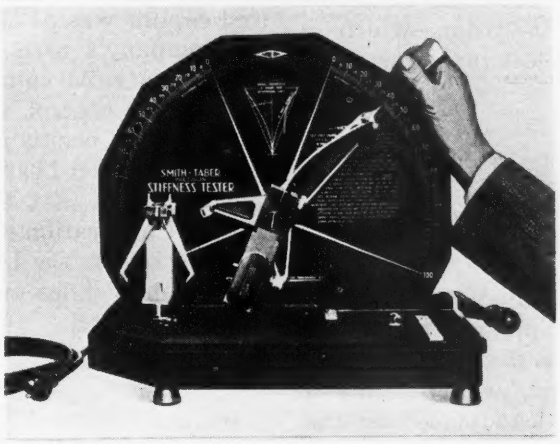
Speedway Motor that Weighs Only About One Pound

of the shaded-pole type for operation on sixty-cycle alternating current.

The other motor is of the universal type for operation on either direct or alternating current. Both motors can be run direct from 110-volt circuits without the use of transformers. Their skeleton construction provides for easy mounting.

Smith-Taber Precision Stiffness Tester

The stiffness and resiliency of such materials as thin sheet metal, wire, and synthetic plastics can be determined by means of a precision instrument recently developed by Smith-Taber, North Tonawanda, N. Y. This instrument will test wire from the finest filament up to 0.050 inch in diameter, and sheet material from the thinnest foil up to 0.010 inch thick. It is said that the design of the instrument and its extreme sensitivity make possible an accurate measurement of the plastic flow that takes place within a deflected specimen.



Stiffness Tester for Thin Sheets and Small-diameter Wire

Because of this flow characteristic, the term stiffness is divided into "initial stiffness" and "basic stiffness," and the time element is injected when performing the basic test. "Basic stiffness" is determined by following the initial reading with others taken at three-minute intervals until the plastic flow has practically ceased. The stiffness usually becomes stabilized in from three to thirty minutes. Readings can be charted on cross-section paper and the resiliency of the specimen rated on a percentage basis.

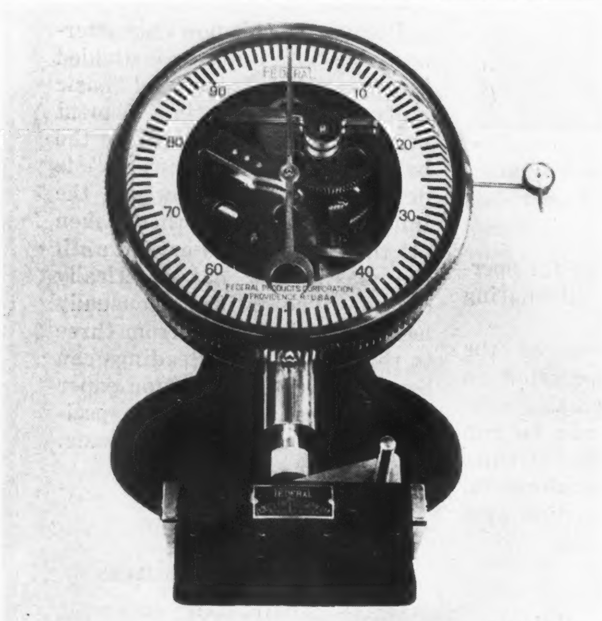
* * *

A Favorable Business Indicator

If history repeats itself, the current trend of machine tool orders definitely indicates the advent of a general business recovery, according to statistics prepared by the Warner & Swasey Co., Cleveland, Ohio. The company's chart of average daily numbers of orders thus far in 1933 is almost identical with the chart for 1922. Both charts show a volume of orders starting from a low point, moving upward in the second quarter, and rising sharply in the third quarter. The rate of increase is practically identical in both cases. "The deferred demand for machine tools today is larger than was the case at this time in 1922," says Philip E. Bliss, president of the company. "Even more equipment is in need of replacement or repair than was the case at that time." This is good news for industry.

A Giant Dial Indicator

The Franklin Institute in Philadelphia is just ready to open a permanent industrial museum. Here will be shown the development of many types of machinery and equipment. The aim will be to present exhibits in such form that the underlying principles of the various devices will be easily understood by visitors. Among the exhibits will be a dial indicator of such a large size that its mechanism can be clearly seen. This indicator is built by the Federal Products Corporation, Providence, R. I., and is the largest dial indicator, complete in details and proportion, ever built; it is approximately 13 inches in diameter. The small indicator shown to the right in the illustration, which is 1 inch in diameter, is the smallest indicator made by the same company.



The Largest Dial Indicator Ever Made—A Federal Indicator 13 Inches in Diameter in the Permanent Exhibition of the Franklin Institute at Philadelphia

* * *

A Weighing Scale that Gives a Printed Record

Human errors can be eliminated in receiving, storing, manufacturing, and shipping departments by the use of a scale recently developed by the Toledo Scale Co., Toledo, Ohio, which prints a record of the weight of each load placed on the scale. The weight is printed instantly at the touch of a button. An inserted ticket, a continuous strip, or both can be used for the printed record. The printing device can be furnished on scales ranging from 62 1/2 to 10,000 pounds capacity.

Thirtieth Anniversary of Ford Motor Co.

The Ford Motor Co., which was founded in 1903, celebrated its thirtieth anniversary by an Exposition of Progress held in Detroit late in October and early in November. This exposition was attended by approximately 1,200,000 people, breaking all attendance records for any single event in the state of Michigan. The exposition was held in the Convention Hall, where more than 175 manufacturers displayed their contributions to the manufacture of the present-day automobile. The Ford Motor Co. announced that last year it had spent $163,700,000 in the purchase of materials and parts from these and other manufacturers—a statement that emphasizes the wide ramifications of the motor-car industry.

At the exhibit, all-steel automobile bodies were welded together in giant machines, fabrics were woven, and upholstery was manufactured by a sewing machine weighing eight tons.

The first car built by Ford was on display in a replica of Ford's first tiny brick work-shop, in Detroit, where his first car was built in 1893. In addition, there was also a collection of other antique automobiles of the early horseless-carriage era. This collection included a two-cylinder Austin steamer dating back to 1863, a Benz of 1888, and a first Model T of 1903. A number of machine tools used in that first work-shop, including a lathe and a drill press, were also shown.

* * *

General Motors Corporation Celebrates Twenty-Fifth Anniversary

The General Motors Corporation, formed in 1908, is just celebrating its twenty-fifth anniversary. When the company was incorporated, there were only 197,500 motor vehicles in the country. Today there are more than 24,000,000, of which approximately one-third came off the General Motors assembly lines. In 1908, the corporation's authorized capital was $12,500,000. At the close of 1932 the company's assets were $1,115,000,000. More than seventy-five companies operate under the General Motors control, and products of its subsidiary and affiliated companies cover such diverse articles as ball and roller bearings, spark plugs, Frigidaires, and airplanes. At the present time, the General Motors Corporation produces nearly one-half of all the cars sold in the United States, and one-third of all the automobiles made in the world.

* * *

We are informed that the Black & Decker Mfg. Co., Towson, Md., has, since April, shown a constantly greater increase in volume of business and earnings month by month. The company now employs considerably more than twice as many people as in April.